

AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

Engineering Advances in AUTOMOTIVE FASTENERS

by **Frank Masterson** • President, Industrial Fasteners Institute

Roy P. Trowbridge of General Motors, second from right, discusses fastener standards with Frank Masterson, right, and with R. B. Belford (left), IFI technical adviser, and Prof. Dan K. Wright, Jr., (second from left), of Case Institute of Technology

JUNE 15, 1960

ALSO IN THIS ISSUE

ARMORED VEHICLES IN
AMERICA'S FUTURE

MALLEABLE IRON
MAKES BIG GAINS

ENGINE BUILDING AT
CATERPILLAR PLANT

GEARS PRODUCED ON
AUTOMATED LINE

MANAGEMENT
ENGINEERING
DESIGN
PRODUCTION



170 OPERATIONS

73 HOLES

starting from solid

DRILL

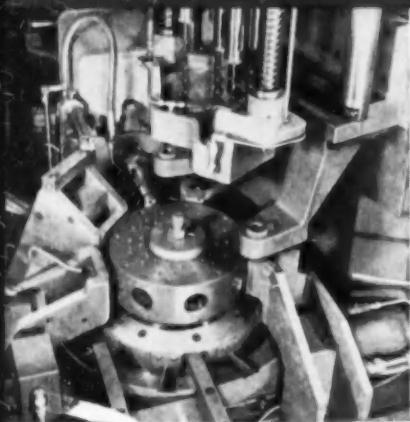
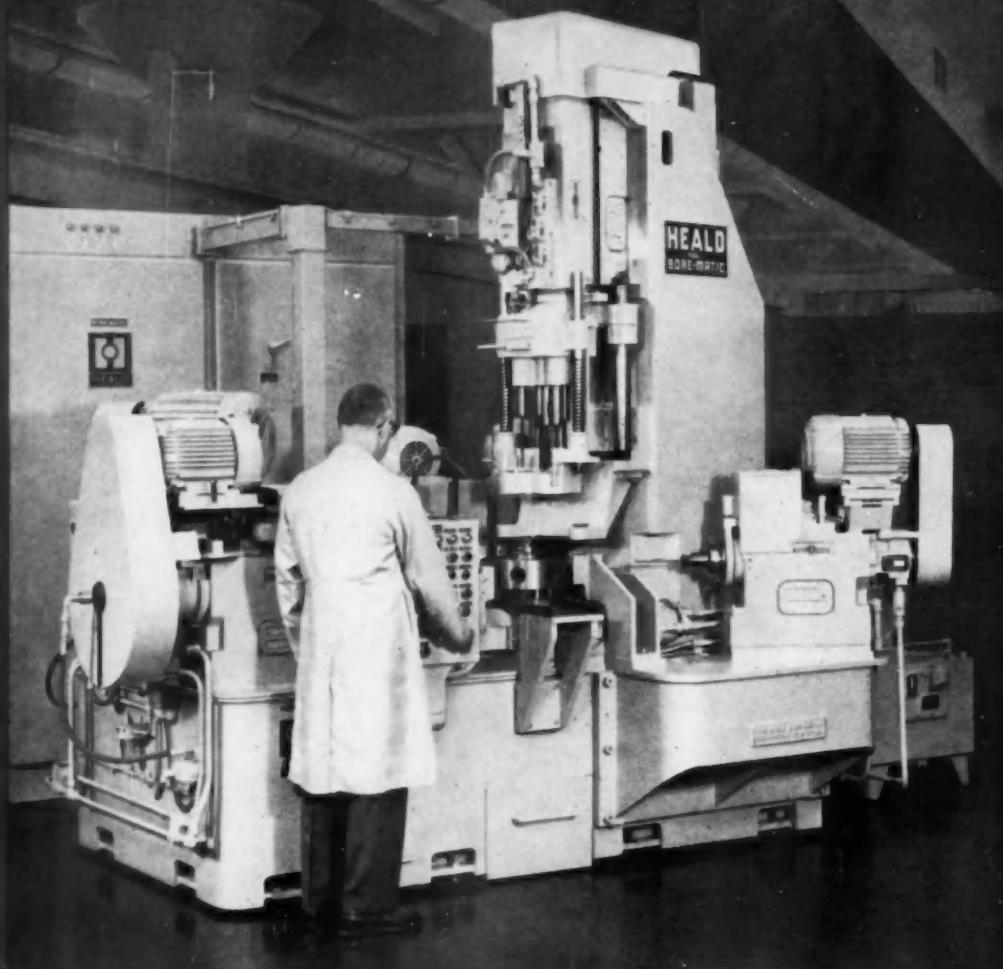
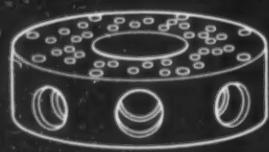
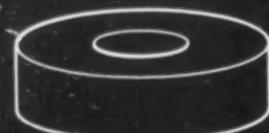
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BORE

COUNTER-BORE

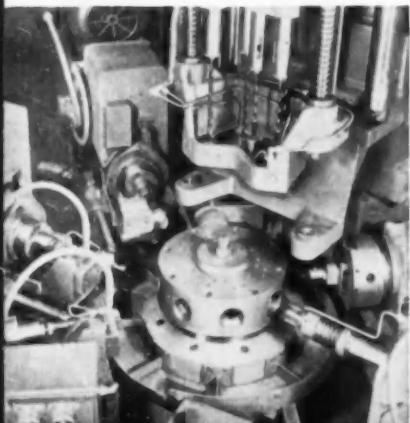
GROOVE

TAP



Above — Work stations on first machine
(shown in large photo)

Below — Work stations on second machine



Two 6-station Model S Bore-Matics UP PRODUCTION 519%

This cast-iron hydraulic motor body used to be produced on three different machines, with a total production time of 286 minutes per part. Now it is done on two 6-station Model S Bore-Matics in 46 minutes!

Each machine is equipped with Heald Red Head Borizers to rotate and feed the tooling, and a rotary indexing workholding fixture. Once the part is loaded, all operations are performed in sequence in a fully automatic cycle. After operations on the first machine

are completed, the work is turned over and put on the second machine where the remaining operations are finished from the opposite face.

This job demonstrates the unusual versatility of Heald Borizer units—and their ability to handle heavy stock removal while maintaining required accuracy for each of numerous sequential operations. For complete details on this particular application, send for a copy of the April 1960 issue of the "Heald Herald."



It PAYS to come to Heald

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Subsidiary of The Cincinnati Milling Machine Co.
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A small fable with a large moral



Farmer owned a sleek Jersey cow.

*He milked the cow every day,
and his children drank every drop.*

One day a neighbor said to him:



"Charlie, my cows give more milk than I need.

*I'll sell you a bucket a day very cheaply,
and you won't have to bother with milking any more."*

The Farmer had a nose for bargains.

*He accepted the deal. Instead of milking twice a day,
he had more time to watch TV.*

Then one day his neighbor's wife had triplets.

They no longer had any milk to spare.

*The Farmer tried to milk old, faithful Bossy,
but—alas—she had dried up.*

MORAL: If you don't milk the cow you have, some day you may be awfully thirsty.

Whether you're a farmer or steel buyer, your safest, most reliable suppliers are right here at home. No one knows the needs of American steel buyers better than American steel makers. To serve you, and serve you well, is our primary concern—not just today and tomorrow—but year after year.

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

JUNE 15, 1960

Passenger Cars • Trucks • Buses • Aircraft • Tractors
• Engines • Bodies • Trailers • Road Machinery •
Farm Machinery • Parts and Components • Accessories
• Production and Processing Equipment •
Design • Production • Engineering • Management

VOL. 122 No. 12

Features • • •

▼ Advances in Automotive Fasteners

Cooperation between the Industrial Fasteners Institute and the automotive industry is discussed by Frank Masterson, President of the IFI.

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▼ Armored Vehicles in America's Future

Part I

The advent of nuclear weapons has increased the need for armor on future battlefields. Some of the requirements are discussed by Raymond J. Astor, Major, Ordnance Corps, U. S. Army.

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▼ Malleable Iron Makes Big Gains

New automotive applications for malleable iron parts are providing a larger market for this material. The compact cars use an average of 80 lb of malleable.

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▼ Users Want More Industrial Engines

Over 63 per cent of buying companies polled by Automotive Industries indicate increased purchases this year.

Page 70

▼ East German Gear Line Automates Standard Machines

An automatic link-line at the Zwickau plant for machining transmission gears features a flexible arrangement of conveyors, etc.

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▼ Developments at Thompson-Ramo-Wooldridge

The Valve Division of Thompson-Ramo-Wooldridge has brought out two new engine accessories, both of which are described here.

Page 74

▼ Metal Finishing in the Body Building Plant, Part II

Various ways in which a reduction in the cost of abrasives can be accomplished are discussed in an article by R. D. Bottenfield and F. J. Quinn, of the Carborundum Co. This is part II of a two-part article.

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▼ Building Engines at Caterpillar Plant

The new Mossville plant of Caterpillar Tractor Co. is turning out V-8 and V-12 engines and modifying other Caterpillar engines for special purposes.

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▼ 32 New Product Items and Other Features, Such as:

Machinery News; Construction Equipment; Manufacturer's News; and Industry Statistics.

... continued on next page

MEMBER



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He's mopping up the mess for the last time

At a leading aircraft research center, high-frequency vibration caused severe oil leakage from hydraulic lines servicing a huge wind tunnel. Many man-hours each month were wasted cleaning up the basement floor underneath, even though drip pans were used extensively.

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If your plant is troubled with a leaky system, a Suntac antileak hydraulic oil can save you money, too. Ask your Sun representative to show you the Suntac desk-top demonstration, or write direct to **SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AA-6. In Canada: Sun Oil Company Limited, Toronto and Montreal.**

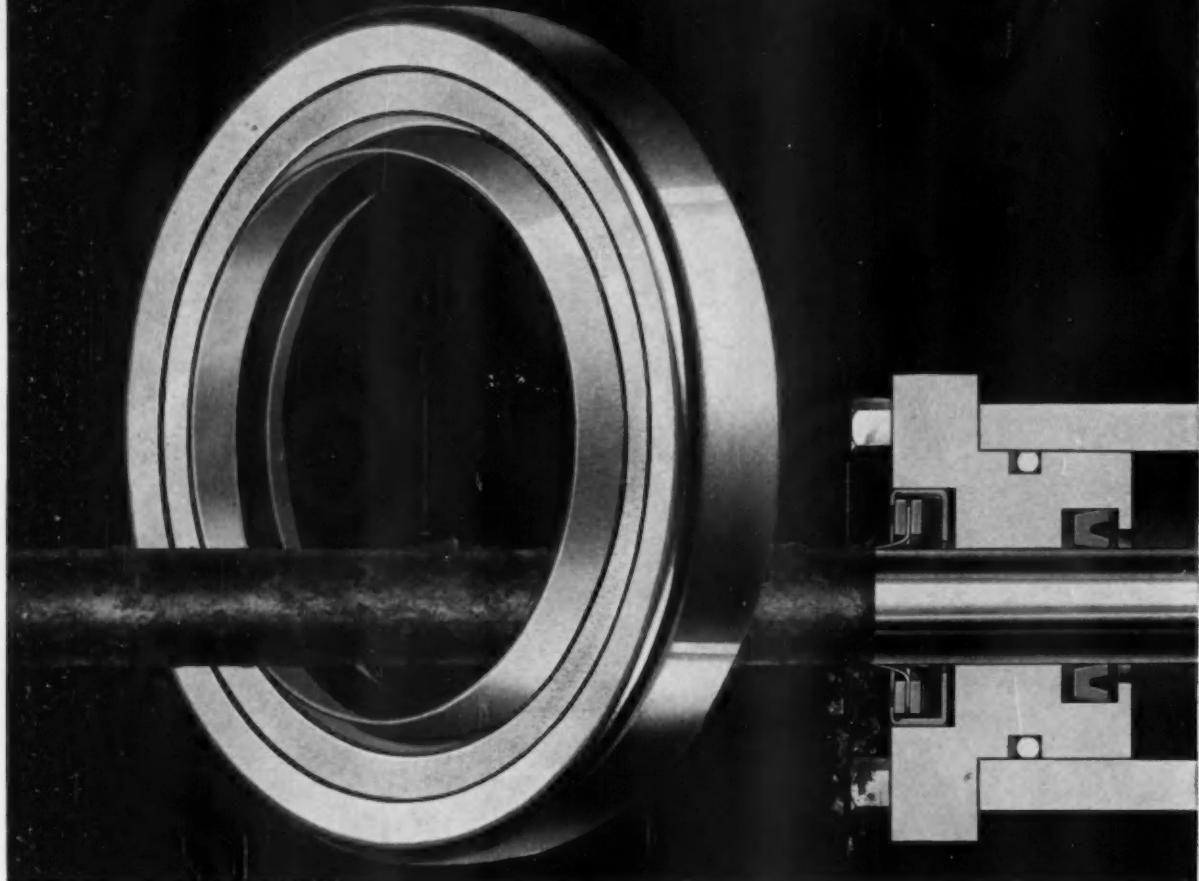
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AUTOMOTIVE INDUSTRIES, June 15, 1960

Circle 106 on Inquiry Card for more data



ANOTHER NEW PRODUCT DEVELOPMENT FROM C/R



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Scrapes off ice, mud, tar — wipes off water, dust, other contaminants

Now, you can effectively exclude dirt and other contaminants from hydraulic cylinders under the most severe field conditions. One compact unit, the C/R SC Wiper-Scraper Seal does the job. Formerly, a separate rod scraper had to be installed in front of the ordinary wiper seal. The special machining necessary, plus the scraper ring, and retaining ring made this an expensive installation.

Chicago Rawhide's SC Wiper-Scraper Seal combines a spring brass scraper and synthetic rubber wiping member in one steel shell. The I.D. of the scraper is slightly under shaft size to provide a snug fit that will remove tar or frozen mud, but it has sufficient play within the shell to tolerate any off-center conditions of the rod such as caused by bearing "bore-slop." The cost is much lower than any other

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For complete information, specifications and standard sizes, write for your copy of C/R's new Bulletin SC-100



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Exclusive Victor Aluminum Precote speeds heat transfer . . . provides higher temperature resistance . . . compensates for irregularities of mating surfaces . . . eliminates need of supplementary gasket cement

This newly developed Aluminum Precote provides simplified gasket installation and insures positive performance on high-temperature engine applications.

Deficiencies in earlier gaskets of this type have been completely eliminated by a new and thoroughly tested aluminum pigmented organic coating, and by refinement of the application method.

New Advantages

- The new processing method permits application of coating to finished gaskets, ready for shipment when coated, thus eliminating possible handling damage.

- Improved coating formula and new application method permit a heavier and completely uniform film on both gasket faces, in controlled thickness from .00075 to .0015 in.

- Controlled baking of coated gaskets at 400 deg. F. gives notably increased resistance to high working temperatures. Precote adhesion to gasket surfaces is improved.

- Resistance to gasket corrosion on contact with antifreeze and coolants is greater—with reduced possibility of blow-by between combustion chamber openings of gaskets.

- The new, higher-heat-converted Aluminum Precote remains soft enough to permit conformance of gasket to mating surface irregularities of engine head, block, flange faces, etc. At the same time new Aluminum Precote has improved properties for easy removal of gaskets.

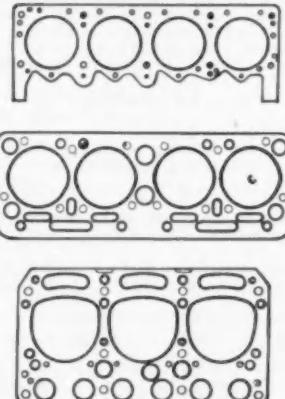
ice—or your inquiry for complete technical data and prices—involves no obligation. Handle through your Victor Field Engineer or direct with the factory. See address below.

New and Improved Facilities Allow High-Capacity Production

Three stories tall, and based on automated conveyor system operation, this Victor installation chemically prepares incoming gaskets, applies and bakes-on Aluminum Precote in



Available Gasket Types and Uses



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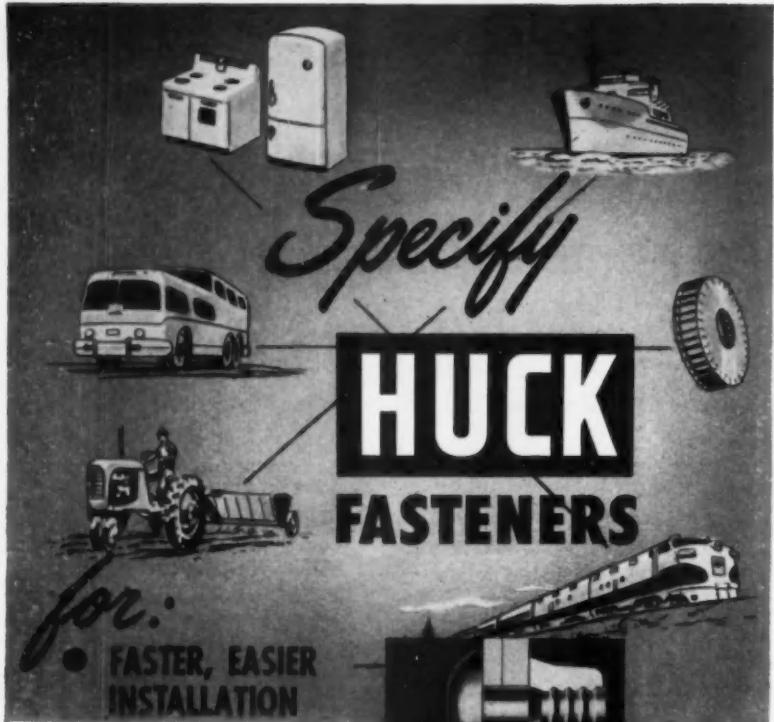
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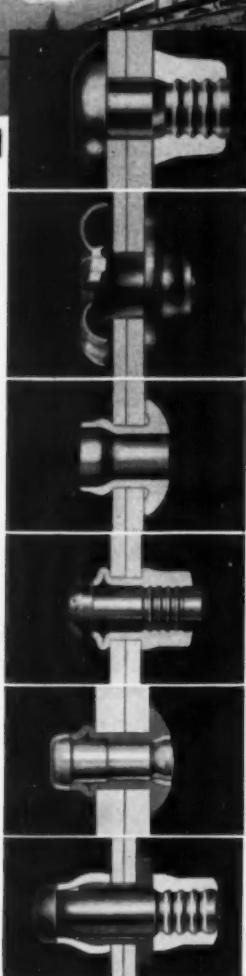
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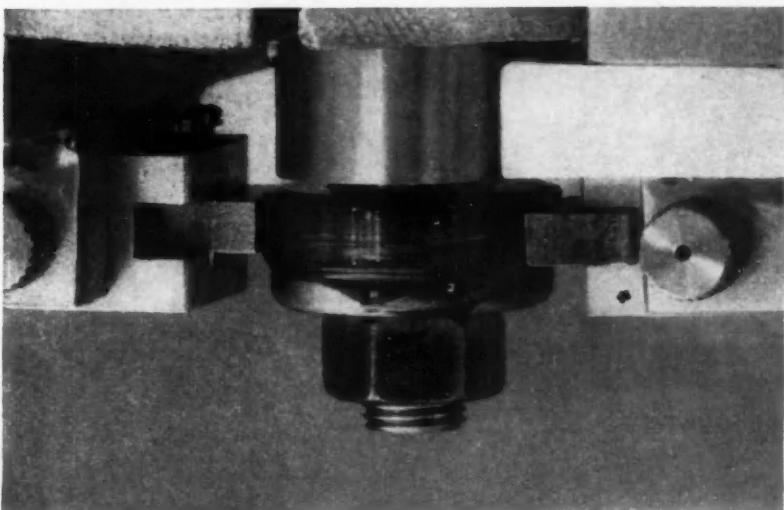
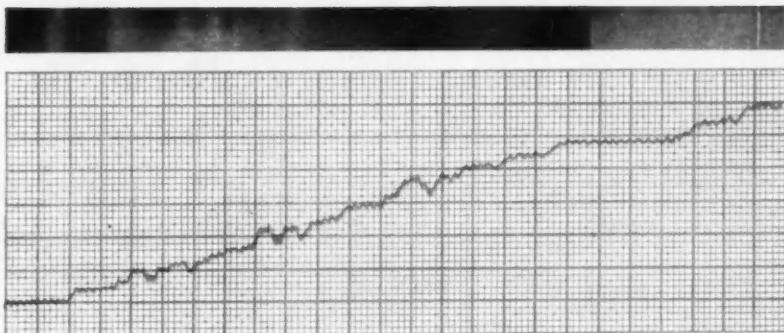
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CALENDAR

OF COMING SHOWS AND MEETINGS

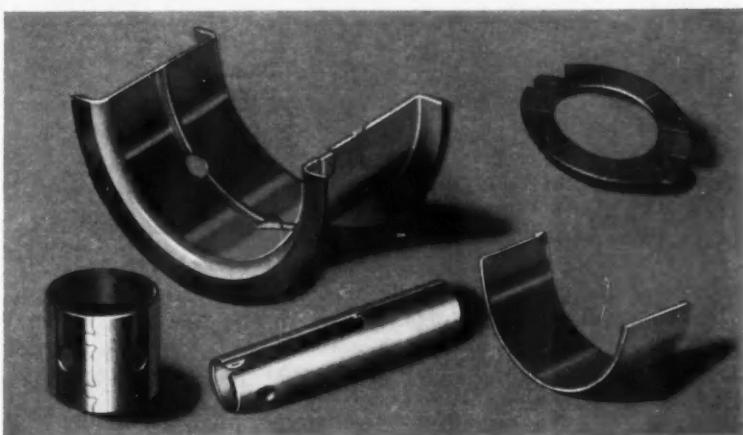
American Society for Testing Materials, 63rd annual meeting, Atlantic City	June 26-July 1
International Trade Fair, Chicago	June 20-July 5
1960 Western Packaging & Materials Handling Exposition, Los Angeles	July 19-21
11th Annual Industrial Research Conference, Harriman, N. Y.	Aug. 7-13
American Astronautical Society, Western National Meeting, Seattle	Aug. 8-11
Summer Institute, Non-Destructive Testing, Sacramento State College	Aug. 15-26
Western Electronic Show and Convention, Los Angeles.....	Aug. 23-26
International Heat Transfer Conference, sponsored by ASME, American Society of Chemical Engineers, and IME, ICE (British)	Aug. 26 to Sept. 1
Machine Tool Exposition — 1960 (sponsored by National Machine Tool Builders' Assn.), Chicago	Sept. 6-16
Production Engineering Show, Chicago	Sept. 6-16
ASME Engineering Management Conference, Cambridge, Mass.	Sept. 7-9
2nd Coliseum Machinery Show, Chicago	Sept. 7-15
Fall Meeting, Material Handling Institute, Virginia Beach, Va.	Sept. 12-13
Steel Founders' Society of America Fall Meeting, Hot Springs, Va.	Sept. 18-20
AWS, National Fall Meeting, Pittsburgh	Sept. 26-30
Cast Bronze Bearing Institute, 1960 Annual Meeting, Asheville, N. C.	Oct. 12
Magnesium Association Annual Convention, Cleveland	Oct. 17-18
42nd National Metal Exposition and Congress, Philadelphia	Oct. 17-21
SPI, "Tooling for the Plastics Industry," New York City.....	Oct. 19
1960 Fleet Maintenance Exposition, New York City.....	Oct. 24-27
15th Annual Technical Convention, American Society of Body Engineers, Detroit	Oct. 26-28
Material Handling Institute Show, Louisville, Ky.	Nov. 1-3
ASTME, Western Tool Show, Los Angeles	Nov. 14-19
Automotive Electric Association, 43rd Annual Meeting and 24th Annual Mfg.-Dist. Conference, Chicago	Dec. 2-9

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Back-country mobility is the special gift of famous Terra-Tires by Goodyear. Running at very low pressure (as low as 2 psi), their wide, flat "footprints" travel highways at regular speeds, keep right on going over rocky or stump-strewn terrain, muddy marshland, deep snow, even shifting sand. Superstrong, Terra-Tires are virtually immune to punctures. And their soft ride usually eliminates need for shock absorbers.

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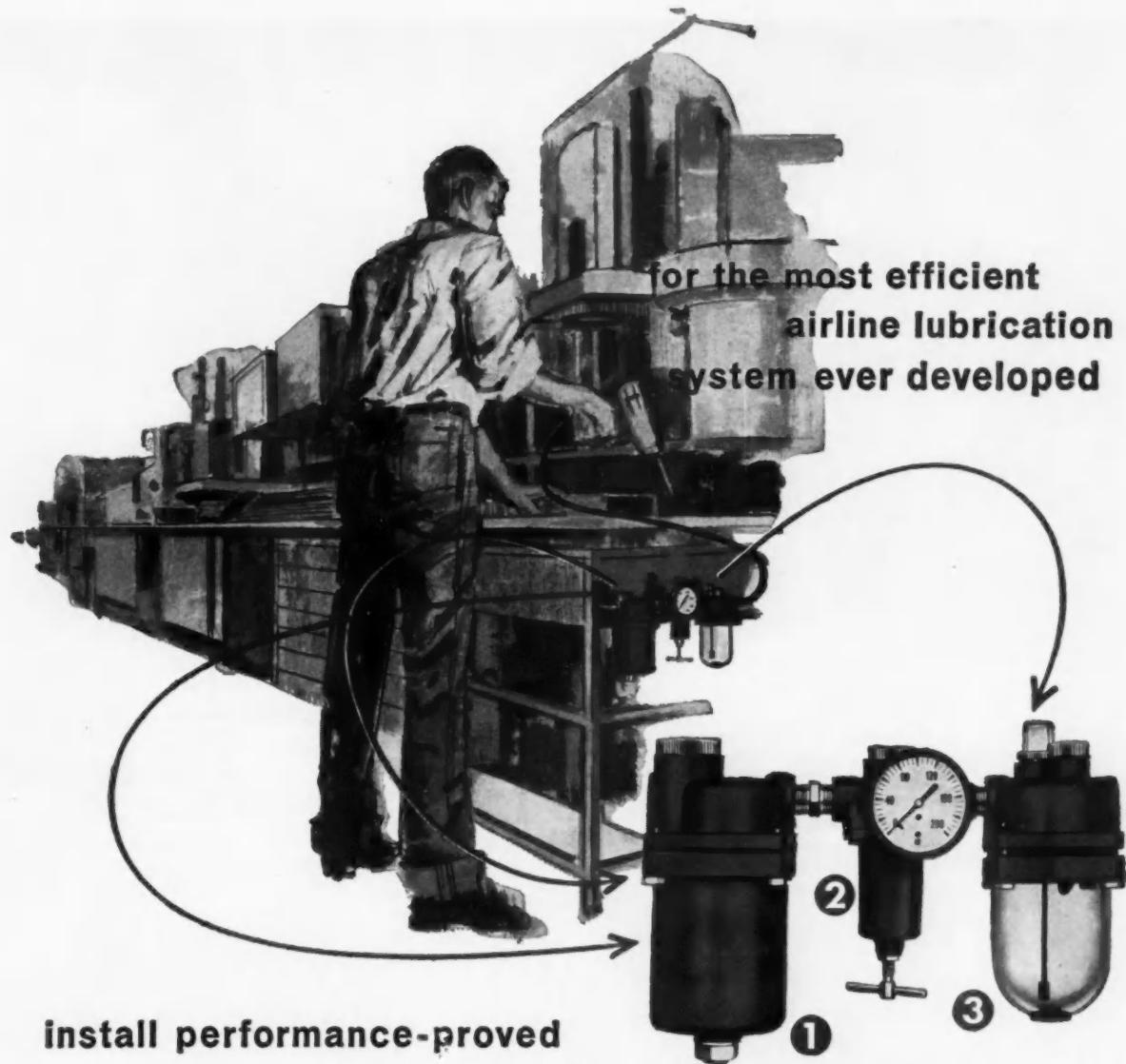
Put this potent pair of terrain-tamers to work on *your* vehicle—you'll find that where the road stops, the pay-off starts with Terra-Tires and Rolli-Tankers by Goodyear. (Design from the beginning for Terra-Tires, and you'll record substantial savings.) Write on company letter-head for details to The Goodyear Tire & Rubber Company, Aviation Products Division, Dept. R-1733, Akron 16, Ohio.

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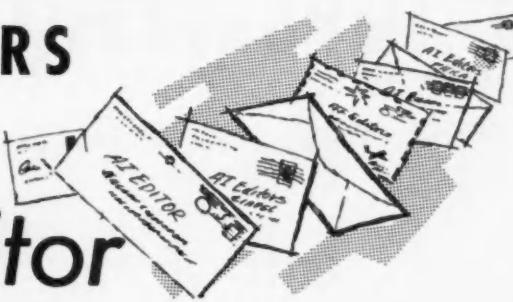


ROCHESTER CARBURETORS

LETTERS

to the

Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address Letters to the Editor, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Penna.

SPECIFICATIONS TABLES

I am a Mechanical Engineer employed by the U. S. Army Corps of Engineers at the above address. I would appreciate receiving a wall chart of the 1960 specifications covering Small Gasoline Engines.

Thank you very much for your consideration.

James P. Lyons
Power Plant Engineer
Quality Assurance Division
U. S. Army Engineer
Procurement Office
Corps of Engineers
Chicago 6, Ill.

- Your wall chart is on the way.
—Ed.

Would you please send to the writer two copies of tables for charts covering specifications on 1960 gas, diesel and small gas engines.

Sherman C. Tremblay
Administrative Assistant
Clutch Division
Lipe-Rollway Corp.
Syracuse, N. Y.

- Will do.—Ed.

INTERNATIONAL STANDARDS

I thought you would like to know that the comments concerning your March article on international standards, both at ASA and from outside interested associations and people, have been most favorable.

Sheldon Osborn
Account Executive
Ketchum, MacLeod & Grove, Inc.
New York, N. Y.

ROLL OVER SIMULATOR

In the March 15 issue of your magazine, we noticed an article "Roll Over Simulator" by Norris E. Shoemaker, Cornell Aeronauti-

cal Laboratory, Inc. As we are very interested in this article, may we ask you to furnish us with the address of the Cornell Lab, to enable us to contact them to secure a copy of this publication.

Heintz W. Gerth
Daimler-Benz of
North America, Inc.
New York, N. Y.

- Cornell Aero Lab., 4455 Genesee Street, Buffalo 2, New York.
—Ed.

AI STAFF

I can't tell you how much I enjoyed the opportunity of talking to your staff in Detroit. I must compliment you on the caliber of men who are helping you to make a success of this paper of yours.

My only regret is that I did not have more time to spend with you. Perhaps this can be remedied in the near future.

Henry C. Silldorff
Chairman of the Board
G. M. Basford Co.
New York, N. Y.

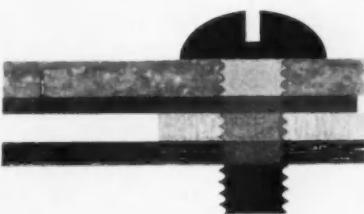
ALUMINUM V-8 ENGINE

The article on "Design and Production Highlights of Rolls-Royce Aluminum V-8 Engines" presented in your February 15 issue has very interesting information about cylinder protection provided for the cylinder liners.

We would appreciate anything you can do to provide us with the composition of this paint and the name of its manufacturer so that we can identify its American counterpart.

Anker K. Antonson
Chief Engineer
Advanced Design Engineering
Fairbanks, Morse & Co.
Beloit, Wis.

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Tough
Applications
Standardize 100% on
SOUTHERN
fasteners



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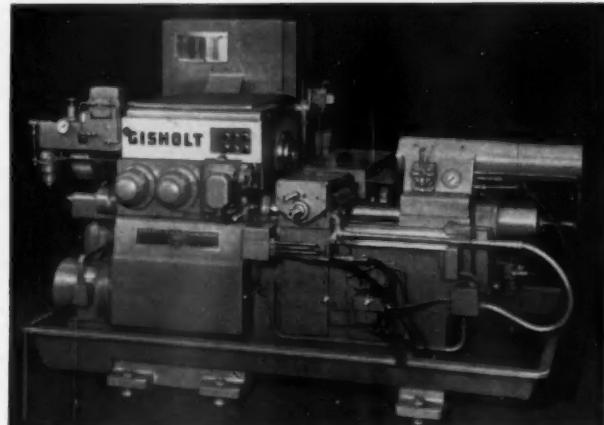


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Gisholt No. 12 Automatic Chucking Lathe

You don't have to sacrifice one advantage for another because here is an ideal combination of all in the industry's most modern high-production automatic chucking lathe.

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GISHOLT
MACHINE COMPANY

Madison 10, Wisconsin



Investigate Gisholt's Extended Payment and Leasing Plans

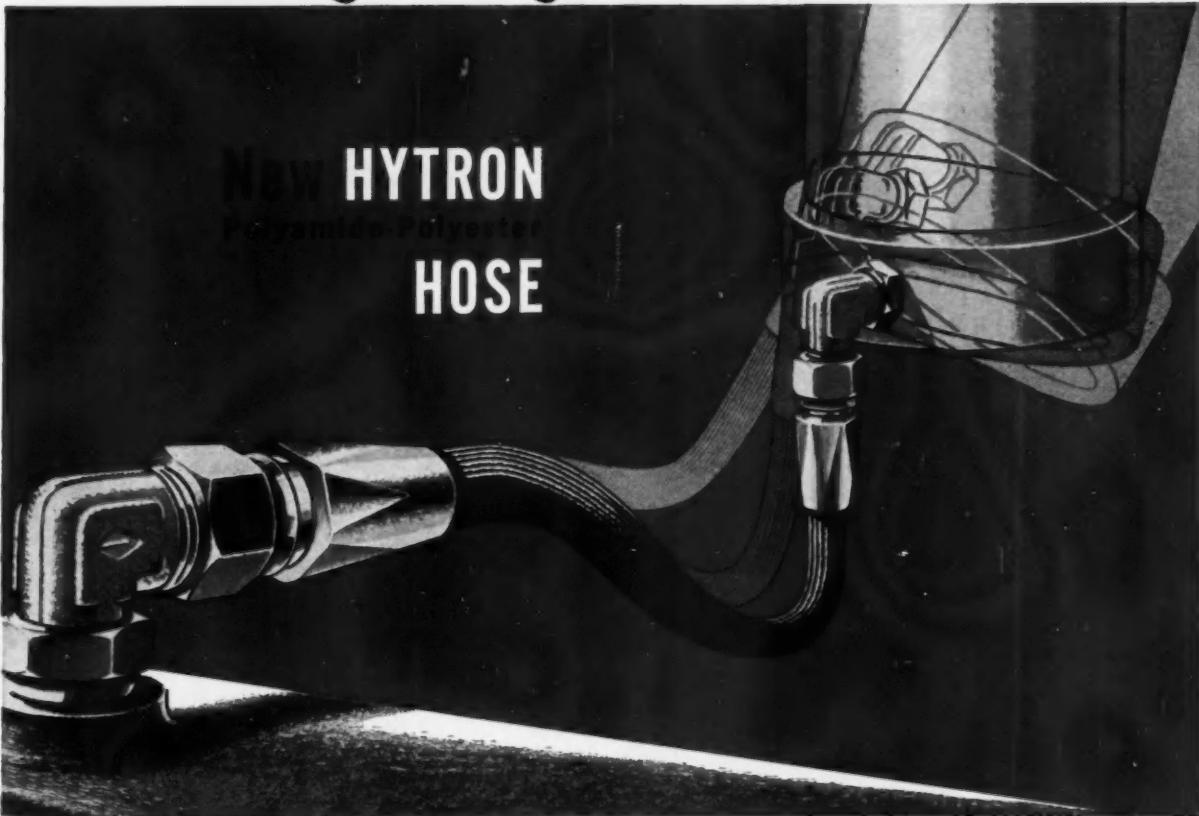
Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • Factory-Rebuilt Machines with New Machine Guarantee



IMPERIAL

Engineering and Data File

New HYTRON Polyamide-Polyester HOSE



FAR GREATER FLEX-IMPULSE CAPACITY... IMPROVED PRESSURE HOSE PERFORMANCE

Imperial unveils a completely new concept in pressure hose — opening new opportunities in hydraulic and pneumatic circuitry design, bringing new economies and advantages to thousands of other hose applications.

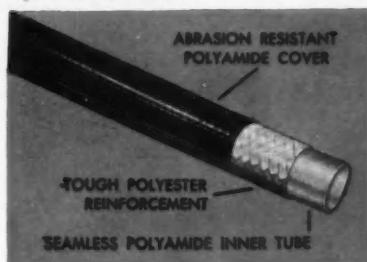
Hytron was created to solve many of the problems encountered in using S.A.E. types 100R1 and 100R5 hose. It radically reduces hose size and weight, offering smaller O.D. for equivalent pressure capacity and I.D.

Flex-Impulse Test Results

Hytron superiority under punishing flex-impulse conditions has been clearly demonstrated. Comparable 24" lengths of hose with couplings were subjected to cycles from 0 psi to 3500 psi at one-second intervals. Simultaneously they were flexed at 60 times per minute.

After 57.4 hours the S.A.E. 100R5 single wire braid rubber hose burst near a coupling. It took 415.5 hours —

over seven times as long — before the Hytron hose failed.



Note that there is *no wire braid* in Hytron hose. This eliminates one of the major causes of fatigue failure. Hytron is 80% lighter in weight, and, unlike wire braid rubber hose, retains virtually all of its flexibility under pressure.

Imperial Hytron hose operates in a burst pressure range from 9000 to 12,000 psi, depending on size and temperature. It is recommended for continuous

service with fluids from -40 to 225°F, and for intermittent service to 250°F. Hytron is unaffected by nonflammable hydraulic fluids up to 180°F and flammable fluids up to 225°F.

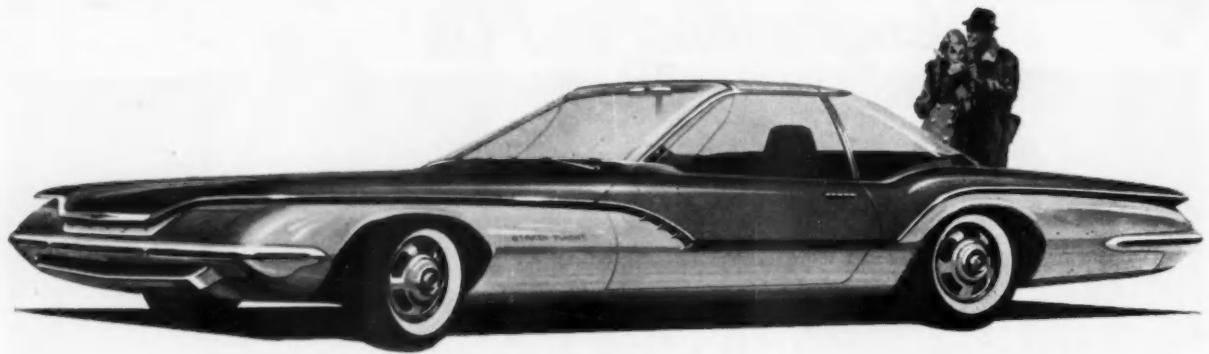
Hytron hose is available in exceptionally long lengths. Furnished as factory-made assemblies, or with easy-to-install reusable couplings. Hytron couplings are of a new design that greatly minimizes flow restriction, offering up to 157% greater flow capacity.

IT'S IN THE BOOK

A new engineering report on Hytron hose and couplings contains detailed test results and performance figures. Send for your copy of Form No. NEPR-500 today.



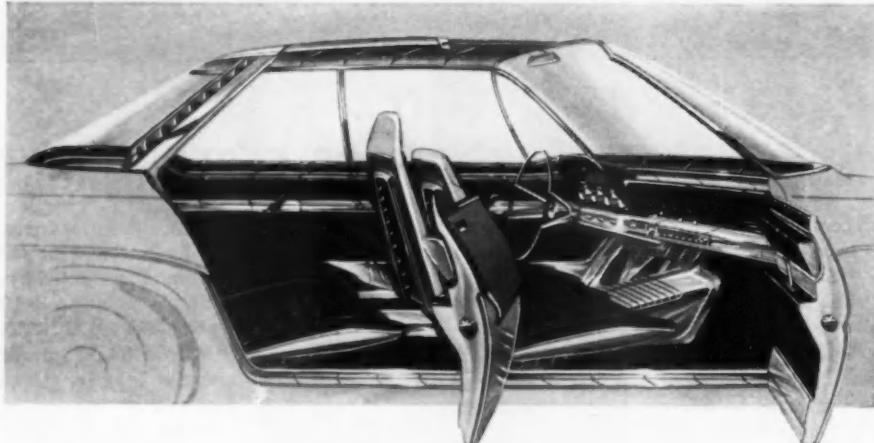
THE IMPERIAL BRASS MANUFACTURING CO.
Dept. AI-60, 6300 West Howard Street
Chicago 48, Illinois



stainless steel

No other metal has the strength, beauty and versatile qualities that serve you so well today and promise so much for tomorrow.

**There is nothing
like stainless steel
for AUTOMOBILES**



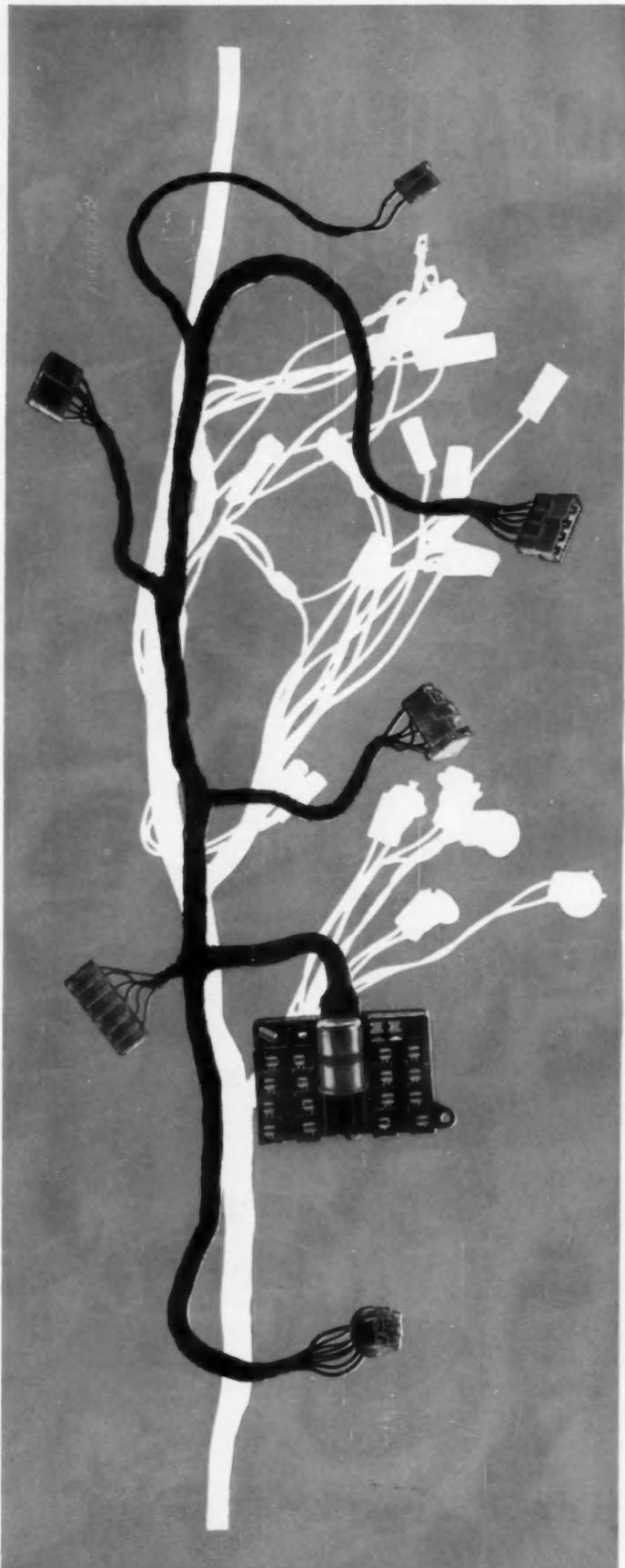
McLouth Steel Corporation,
Detroit 17, Michigan

*Manufacturers of high quality
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Look for the **STEELMARK**
on the products you buy.

McLOUTH STAINLESS STEEL



Packard Wiring Systems

SAVE ASSEMBLY OPERATIONS!

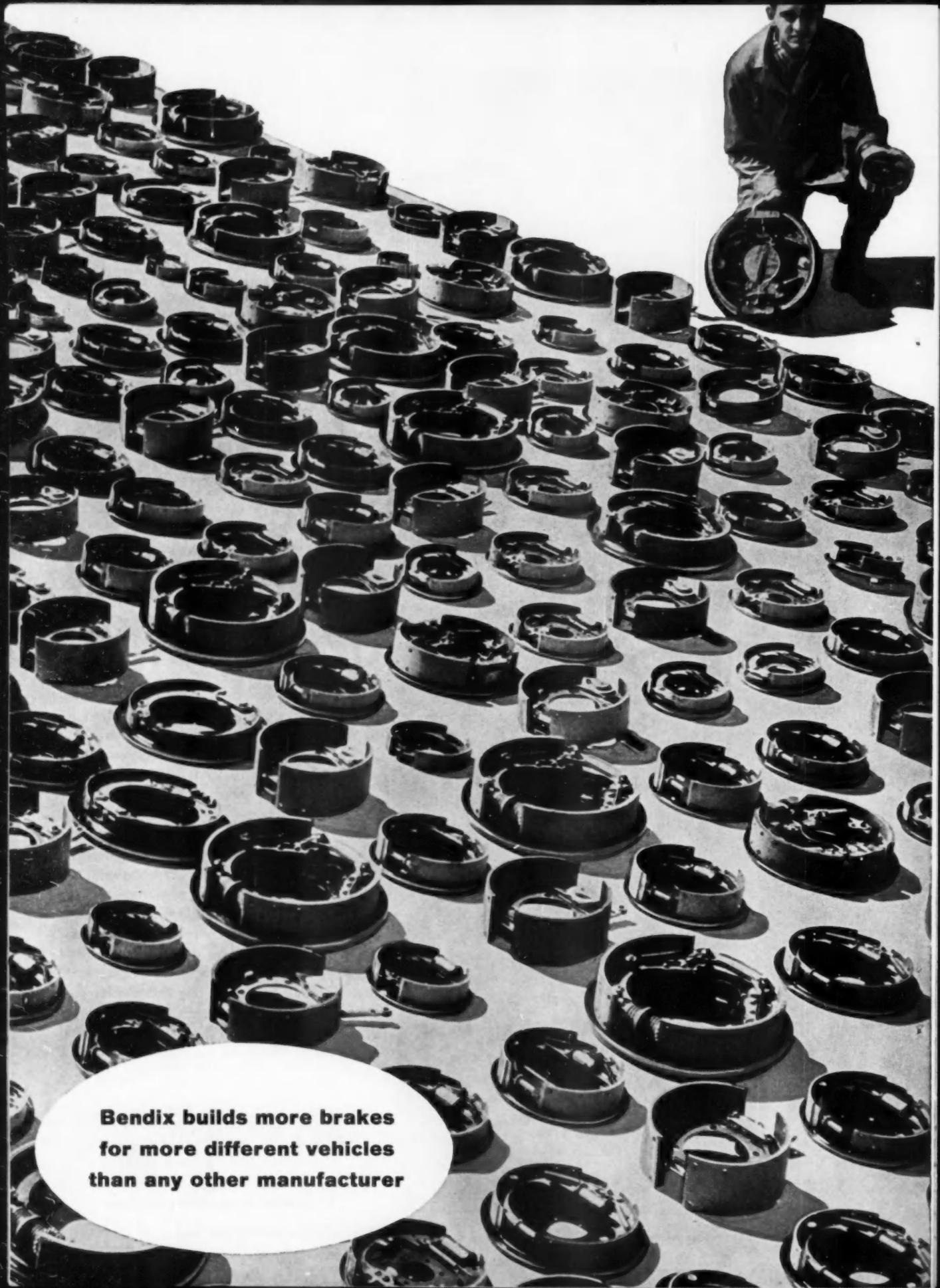
Packard Electric engineers strive continually to make their products less expensive and faster to install. Now they have made it possible for the already efficient automotive wiring harness to become an even more complete sub-assembly. • For example, the dome light of the Corvair is attached to the wiring harness at Packard and shipped ready to snap into the roof of the car along with the wiring. Single terminals are replaced by "Snap Fast" multiple connectors, fuse blocks and other cost-saving components. • If your present wiring harnesses do not include these advantages ask Packard Electric engineers to help work out modern wiring systems for you. Packard Electric, the world's largest producer of automotive wiring systems, has sales and engineering offices in Detroit and Chicago.

Packard *Electric*

Warren, Ohio



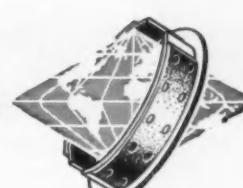
"Live Wire" division of General Motors



**Bendix builds more brakes
for more different vehicles
than any other manufacturer**

400 REASONS WHY: It pays to put your braking problems up to Bendix

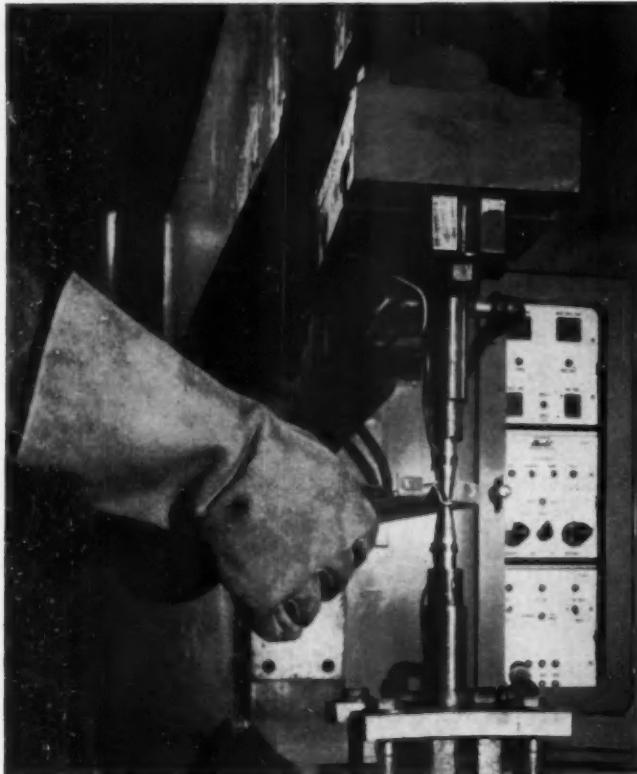
Shown at the left are just a few of the automotive brakes now in production at Bendix. Actually, our current production schedules call for *more than 400 different types of automotive brakes, alone.* § There are many reasons for this industry-wide faith in Bendix ability. Most of these reasons, however, can be listed under the headings of experience and know-how. § In 40 years of intimate association with the problems of automotive braking, Bendix has made major contributions. These include four-wheel brakes, Duo-Servo® braking, automatic brake adjusters, and power braking —among others. § Because engineering and manufacturing dependable braking systems is our business, we are more than ordinarily interested in testing. *Bendix conducts more brake pre-testing than any other organization in the world.* Exhaustive laboratory- and road-testing are conducted on each and every brake design before it is approved for production. You can feel confident in bringing your braking problems to Bendix. With proved capabilities and careful attention to every detail, Bendix has the answers you seek. Call on our Customer Application Engineers at any time for information and advice. There is no obligation.

BRAKE HEADQUARTERS  OF THE WORLD

Bendix PRODUCTS DIVISION South Bend, IND.



NEW FEEDBACK CONTROL makes every weld count



Information from electrodes is fed back to **Monautronic V-2** in background. Control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.



Now, with the new **Monautronic V-2** welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode shape and tip force, material thickness and surface finish... and compensates for them immediately.

The **Monautronic V-2** automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

CONVENTIONAL .250 SPACING



1ST WELD

3RD WELD

2ND WELD

MONAUTRONIC .250 SPACING



The **Monautronic V-2** overcomes shunting effects by maintaining constant voltage across each weld, regardless of how closely spaced the welds may be. Photomicrographs compare closely spaced welds made with conventional control with those made with **Monautronic V-2**. Notice how shunting of voltage has weakened the center weld made with conventional control, while **Monautronic V-2** has kept all welds uniform.

2450 Hunting Park Ave.
Philadelphia 32, Pa.

12141 Charlevoix Ave.
Detroit 14, Mich.

3050 East 11th St.
Los Angeles 23, Cal.

ELECTRONIC  CONTROLS



New BORG & BECK 2-Plate "Strap-Drive" Clutches PACK MORE MUSCLE...WITHOUT ADDED SIZE

Trucks pay out on the road, not in the shop. So it's asking for trouble when a truck engine is too big for its clutch.

To help keep 'em rolling, Borg & Beck has developed a new line of 2-plate clutches with up to 40% greater load capacity . . . yet without any increase in nominal size.

Rated at 500 ft.-lbs. torque capacity, this new Borg & Beck Type 13E2 has 12 $\frac{5}{8}$ " O.D. x 7 $\frac{1}{4}$ " I.D. facings . . . non-cushion rigid or flexible center drive plate . . . space for 16 heat treated coil springs of total load to suit type of service . . . "strap drive" for positive, trouble-free plate separation.

And like all Borg & Beck clutches, Type 13E2 is built to Borg & Beck's pace-setting standards for quality, performance and value. Consult our engineers for details.



Reg. U.S. Pat. Off.



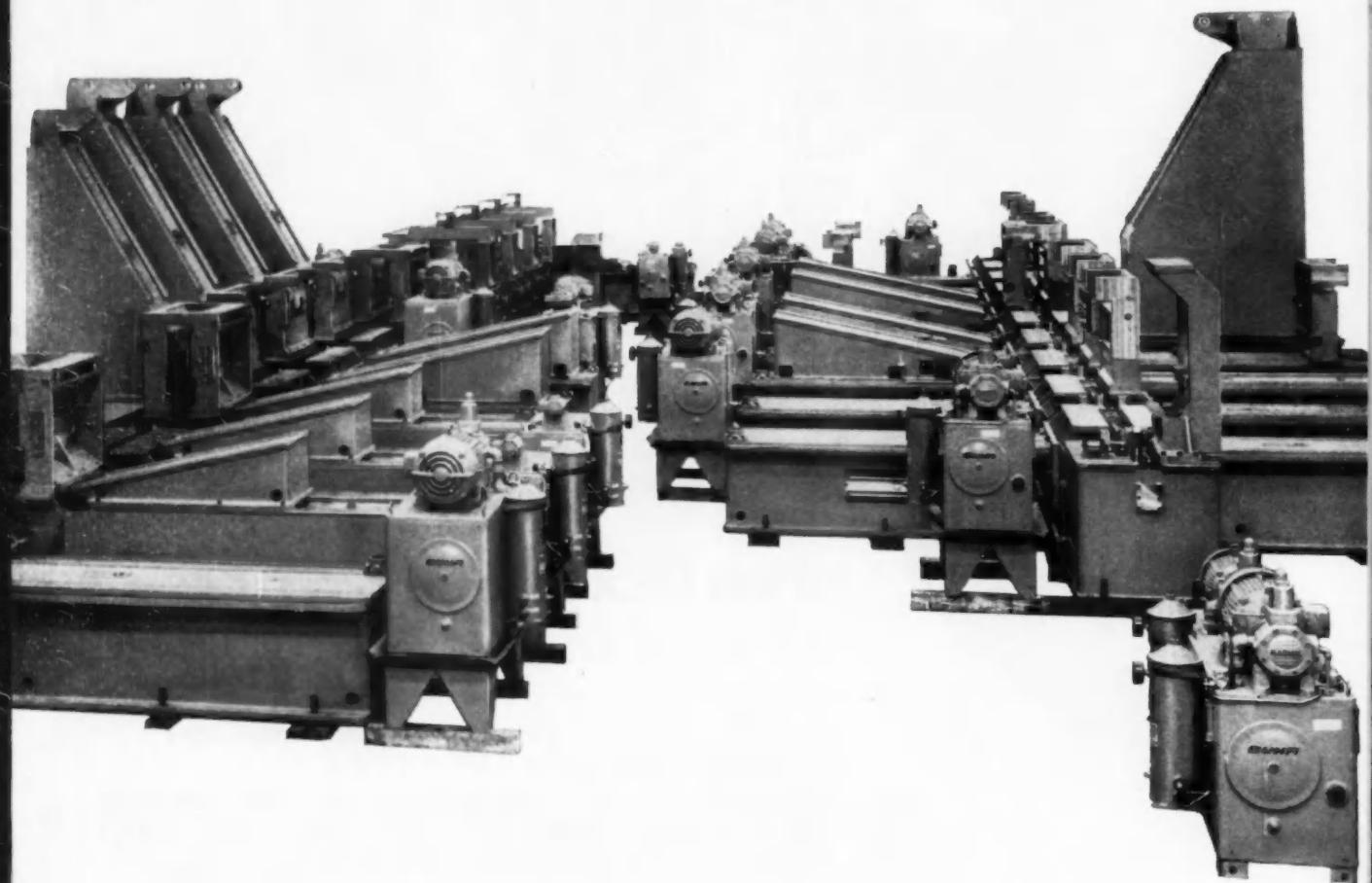
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BORG & BECK DIVISION, BORG-WARNER CORPORATION, CHICAGO 38, ILLINOIS
Export Sales: Borg-Warner International, 36 S. Wabash, Chicago 3

Report to the SMTS Committee*

*SPECIAL MACHINE TOOL STANDARDS

GESTATION PERIOD:



SEE SMTS ECONOMICS • BOOTH 1440 MACHINE TOOL EXPOSITION

.....everything's fine
with ***BUHR'S***
"BABY"

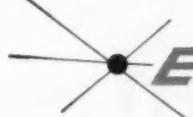
Standard building block by standard building block, Buhr's Baby is fast taking shape. Wing bases, center bases and other standardized components are being assembled and made ready to receive special tooling and auxiliary features which are being completed.

Buhr's Baby, as you may know, is to be an Economatic lift-and-carry transfer—the first major piece of equipment to be built to the Special Machine Tool Standards. This "Baby" will perform 323 precision operations in automatic sequence and will be the most flexible and readily convertible multiple operation machine tool ever built.

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICHIGAN

BUHR

(say BURE)

 ***ECONOMATIC***





Delta Air Lines uses Polyken paper tapes routinely in aircraft maintenance

Delta, too, sticks with Polyken

**More and more big companies are taking
advantage of the new Polyken paper tape line**

Seen your Polyken representative lately? A lot's been happening. That famous Polyken quality, so highly popular and widely proven in plastic and cloth tapes, is now available in paper tapes.

Masking, sealing, bundling, packaging

You get a perfect combination of the right backing and proper adhesive. The result: Polyken paper tapes are a real pleasure to work with.

Conforms neatly, removes cleanly

The tape takes hold at a touch. Removal is smooth, residue-free. Handles easily. Resists both moisture and paint solvent.

Name the need—let your Polyken man provide the specifications and special attention. He's one of the industry's best trained technicians in the use and application of industrial tapes.

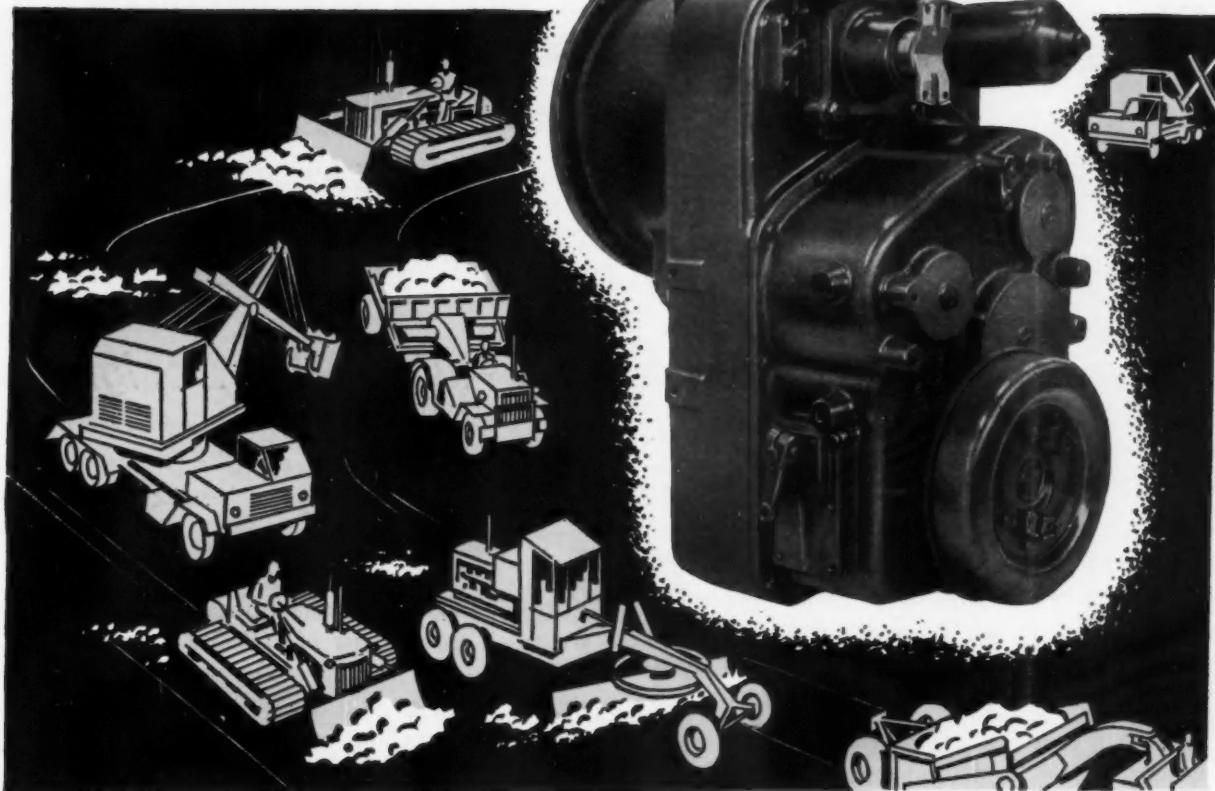


Check with your nearest Polyken Industrial Tape Distributor. Look in the phone book under "Tapes", or write to Polyken Sales Division, 309 W. Jackson Blvd., Chicago 6, Ill. (In Canada, write Polyken, Curity Ave., Toronto.)

Polyken®
INDUSTRIAL TAPES

THE KENDALL COMPANY
Polyken Sales Division

More Performance At Less Cost:



HYDRA-DRIVES® CDB POWER SHIFT TRANSMISSION

A torque converter...and 4-speed transmission in one compact package!

Proved in hundreds of vehicles for four years, these units assure top work output of heavy-duty equipment . . . at a lower initial cost than other models of comparable performance. Engine lugging and heavy shock loads are eliminated. A 3 to 1 torque multiplication makes starting fast and effortless—even with heaviest loads.

Just a flip of the operator's lever accomplishes power shifts within each range and without any interruption of the power flow.

With four speeds forward and reverse, the CDB Hydra-Drives Power Shift Transmission is ideally suited for vehicles which must travel in both directions during a normal work cycle. Rated at 550 ft. lbs. input torque, it can be used with a wide range of internal combustion engines up to 250 H.P.

The CDB model illustrated above is used in connection with a size "C" drop box.

A BDB model is also available, for use with a size "B" drop box on equipment up to 175 H.P.

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ROCKWELL-STANDARD
CORPORATION



Transmission and Axle Division, Detroit 32, Michigan

DU PONT

VITON®

SYNTHETIC RUBBER

Unsurpassed in Fluid and Heat Resistance...

Provides New Dimensions in Automotive Design

VITON, Du Pont's new fluoroelastomer, combines excellent resistance to hydraulic fluids, aromatic fuels, and lubricating oils (including extreme pressure lubricants) with outstanding resistance to high temperatures—at 400° F. in continuous service, at 600° F. intermittently. Result: expanded design opportunities for the automotive engineer.

VITON, in contact with extreme heat and a wide variety of fuels and lubricants, is dimensionally stable . . . retains its physical properties: low compression set, high modulus, and good tensile strength. Its excellent flame, ozone, age and weather resistance, plus a 60-90 Shore A hardness

range, make VITON a versatile design material.

VITON can handle tough design problems that result from higher operating temperatures and recently developed fuels and lubricants. Current and potential applications of VITON include valve stem seals, carburetor pump cups and needle valve tip, speedometer pinion seals, transmission front pump seals, diaphragms, rear axle pinion seals, power steering hose tubes. For additional information, contact your rubber supplier or write for AN INDUSTRIAL REPORT ON VITON. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department AI-6, Wilmington 98, Delaware.

VITON: OUTSTANDING HEAT RESISTANCE

450°F.—	3000 hours
500°F.—	1000 hours
550°F.—	240 hours
600°F.—	48 hours

VITON: OUTSTANDING FLUID RESISTANCE

Fuels:	Tensile strength, % retained	Elongation, % retained	Volume swell, % increase	Hardness change, points
Ref. Fuel (70 isoctane, 30 toluene) @ 75° F. JP-5 petroleum aircraft fuel . . . @ 75° F.	93 100	100 100	2.5 0.4	+1 +1
Automatic Transmission Fluid . . . @ 350° F.	95	95	1.9	0
Rear Axle Oil @ 350° F.	95	100	9.1	+2
Combination Transmission and Rear Axle Oil @ 350° F.	80	89	1.5	0

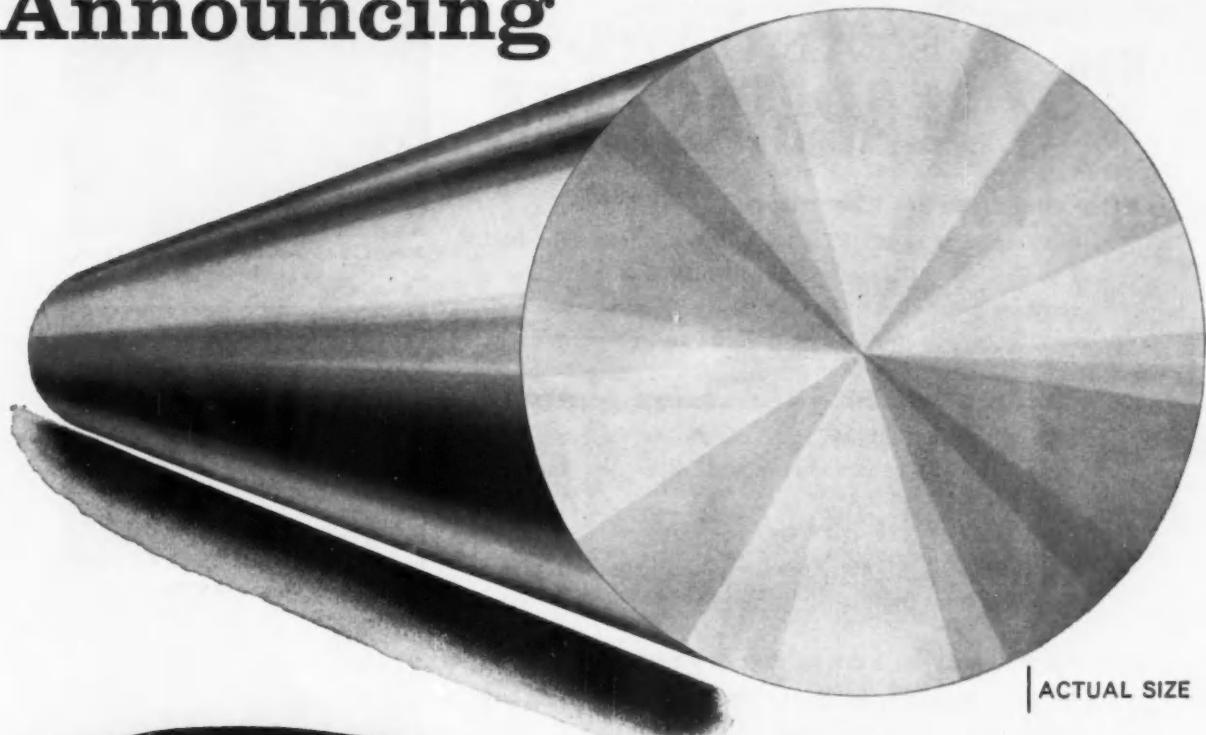


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Five new sizes: 4", 3 $\frac{1}{8}$ ", 3 $\frac{3}{4}$ ", 3 $\frac{5}{8}$ ", 3 $\frac{1}{2}$ ".

Same high strength as smaller diameters...100,000 psi yield.

Fast machining...83% of B1112.

Cost less than heat treated in-the-bar alloys.

Ideal for both production and maintenance applications.

Available from your
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NOW 7* STANDARD LAPMASTERS

FOR PRECISION LAPPING

to a flatness of .0000116" or less with a micro-inch finish of 2 to 3 RMS. All Lapmasters will maintain this uniform accuracy piece-after-piece because conditioning rings continually condition the lap plate during entire lapping cycle.

IN SMALL LOTS OR THOUSANDS PER DAY

with consistent accuracy. Production is not interrupted or slowed down for replacing or reconditioning lap plates.

OF PARTS UP TO 32" DIA.

and as small as $\frac{1}{8}$ " dia. Accurately laps paper-thin pieces as well as giant two-ton parts.

OF ANY SHAPE, FORM OR MATERIAL

tall or squat, long or short, flat or odd shaped...any metal, ceramics or plastic all at the same time if necessary. Inexpensive work holders eliminate danger of stresses and warping usually caused by clamping during grinding or milling.

*For your special lapping requirements, we will build Lapmasters any size.



MODEL 84 for parts up to 32" dia.



MODEL 72 for parts up to 27" dia.



MODEL 10 for maintenance lapping of parts up to 3-11/16" dia.



MODEL 12 for parts up to 4" dia.



MODEL 24 for parts up to 9½" dia.



MODEL 36 for parts up to 14½" dia.



MODEL 48 for parts up to 17" dia.

WRITE FOR THE COMPLETE LAPMASTER STORY

Write for bulletins describing the Lapmaster line and chart on measuring flatness.



Lapmaster
... THE
MACHINE THAT PUT
PRECISION LAPMING ON A
PRODUCTION BASIS

A product of
Crane Packing Company

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CUT YOUR FASTENING COST...

where it matters most!

*Studies have shown that the cost of applying a fastener is more than four times the cost of the fastener itself.



Look to Shakeproof—the Leader in Fastening.



SHAKEPROOF

"FASTENING HEADQUARTERS"®
DIVISION OF ILLINOIS TOOL WORKS

St. Charles Road, Elgin, Illinois

In Canada: Shakeproof/Fastex

Division of Canada Illinois Tools Limited, 67 Scarsdale Road, Don Mills, Ontario

Circle 127 on Inquiry Card for more data

Circle 128 on Inquiry Card for more data →

For each \$1,000 you spend for fasteners, you're probably investing AN EXTRA \$4,000* to install those same fasteners! Shakeproof has found the most effective way to reduce this major part of assembly cost . . . on-the-line engineering.

WHAT IS SHAKEPROOF ON-THE-LINE ENGINEERING?

In your plant, out on the line, a Shakeproof idea engineer carefully studies an assembly operation. By watching, asking and listening, he uncovers fastening problems or areas where product performance can be improved through improved fastening techniques. He then applies his specialized knowledge of fasteners and assembly methods to simplify and improve both the product and assembly operation. He might recommend one of the broad line of Shakeproof fasteners to solve the problem or to increase product efficiency. Or, if greater economies and improved product performance can be achieved with a special-purpose fastener, he will design a Shakeproof product specifically for your application. In either case, the Shakeproof idea engineer will provide you with samples to use and test in your own plant.

Arrange for a Shakeproof idea engineer to visit your plant soon. Discover how Shakeproof On-the-Line Engineering can help cut your fastening cost . . . where it matters most!



SEND FOR THIS FREE BOOKLET "On-the-Line Engineering" gives specific examples of time and money saving Shakeproof fastener applications and offers free samples.

MOS

NEW SYSTEMS TECHNIQUE
PROVIDES CURRENT DATA TO CONTROL
YOUR MANUFACTURING CYCLE...
MAKES YOUR OPERATION MORE EFFICIENT,
WITH FASTER RESPONSE TO CHANGES

IBM MANAGEMENT OPERATING SYSTEM

To coordinate planning and control functions continuously throughout the manufacturing cycle IBM has developed a unique Management Operating System. This system makes use of existing IBM data processing equipment, proved in thousands of industrial installations.

WHAT IS THE IBM MANAGEMENT OPERATING SYSTEM?

MOS is a data processing technique that provides the information needed to control your manufacturing cycle. It is designed to handle automatically the decision data required to carry out related functions, from planning and operations control to evaluation. It provides accurate data on a continuing basis . . . in time for effective management decisions.

WHO CAN USE MOS?

The IBM Management Operating System is a flexible technique that can be applied to most types of industrial operations. Every manufacturing operation is unique, however, and IBM manufacturing representatives have been trained to work with you to adapt the basic concepts to your needs. This is an important aspect of IBM Balanced Data Processing—compatible equipment backed by complete services. It gives you comprehensive support in applying the system to your company's operation.

For full information about the IBM Management Operating System, contact your local IBM office.

HOW IBM
MANAGEMENT OPERATING SYSTEM
PROVIDES DATA TO CONTROL
THE MANUFACTURING CYCLE:

FORECASTING
Sales data
is reviewed to
produce a finished
product plan.

MATERIALS
PLANNING
Materials
requirements
are determined.

MOS

INVENTORY MANAGEMENT

Optimum inventory levels are established and maintained. Purchase orders and manufacturing orders are created.

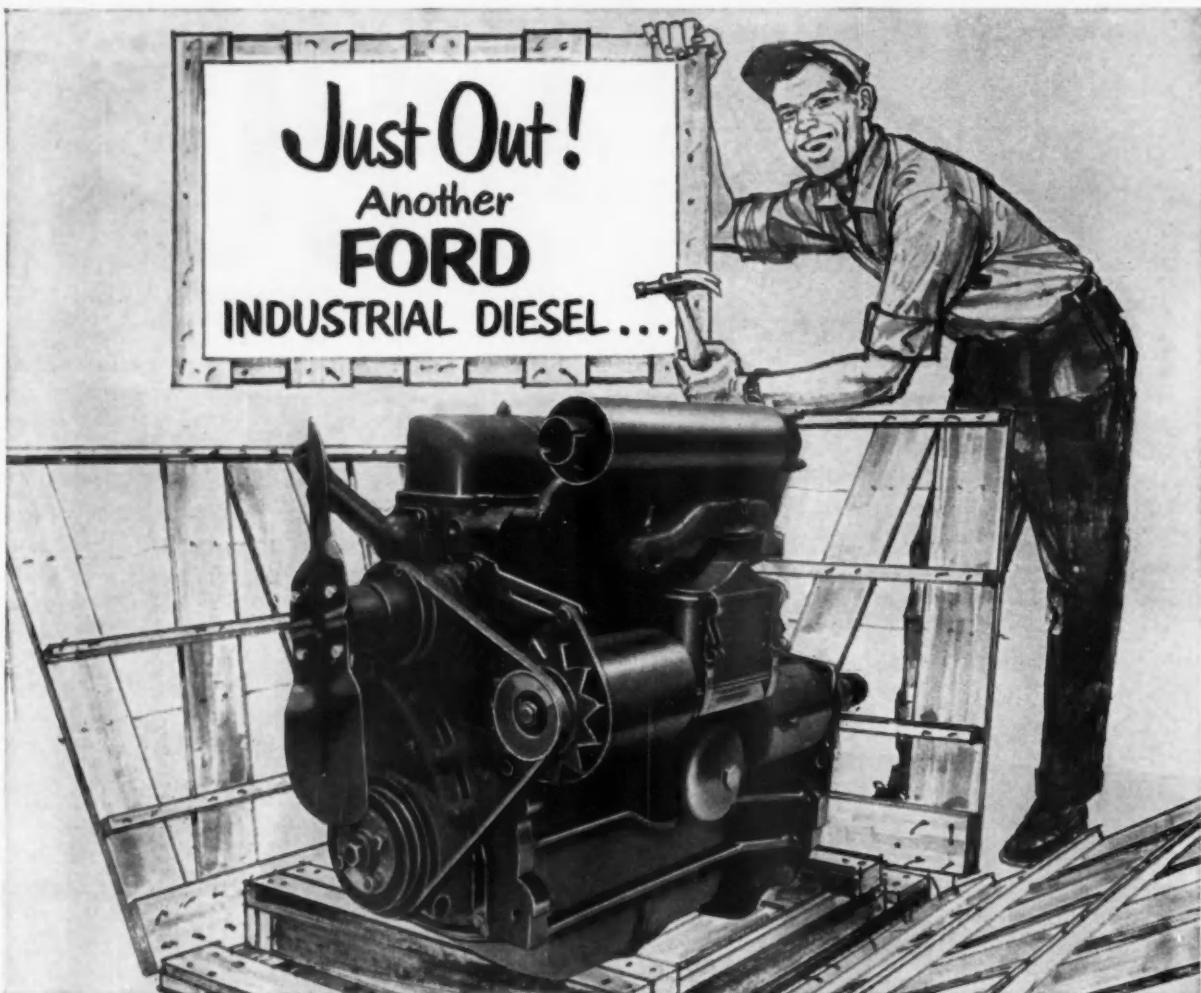
SCHEDULING
Based on customer requirements and available facilities, a manufacturing plan is produced.

DISPATCHING
Work priorities are established to implement the manufacturing plan. Adjustments are made to meet engineering and shop changes.

EVALUATION
Operating data is compared to control standards. Exception reports, on cost and efficiency, are furnished for timely management action.

IBM

BALANCED DATA PROCESSING



Just Out!
Another
FORD
INDUSTRIAL DIESEL...

FORD PRESENTS THE 172 CUBIC INCH DIESEL FOUR !

(and it's interchangeable with the 172-cu. in. gasoline engine)

To meet the growing demand for diesel power, Ford now offers a choice of three economical diesels—the highly efficient 172-, 220- and 330-cubic inch models.

Whichever you select, you'll be getting a completely modern diesel that delivers the high torque necessary to handle tough jobs with outstanding operating economy and easy, low-cost maintenance.

Ford Diesels also offer dependable 12-volt electrical systems for quick starting . . . replaceable cylinder sleeves that eliminate costly reborning . . . and rotating exhaust valves for better seating, longer valve life.

What's more, Ford's 172 Diesel and 172 Gasoline engines are *interchangeable* in your equipment. Many parts, too, are interchangeable between these engines. And low-cost Ford parts and service are always available at any nearby Ford Power or Tractor Dealer.

For greater productivity and more profit in the long run, it will pay you to check the 172 model or other Ford Diesels at your Ford Industrial Products Headquarters.

INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION, FORD MOTOR CO., P.O. BOX 598, DEARBORN, MICH.

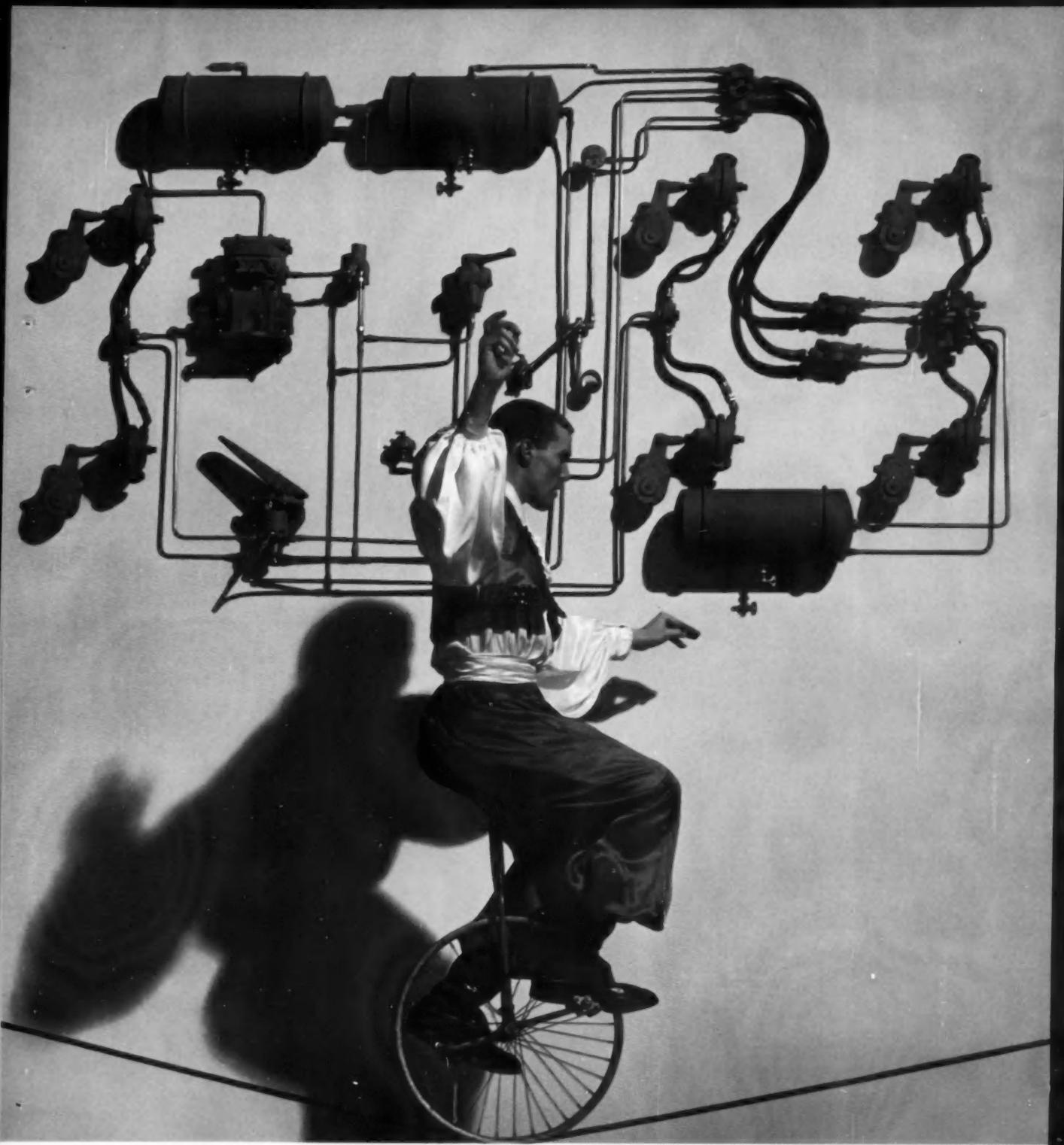
West of Rockies write to:

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FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 1666, RICHMOND, CALIF.

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INDUSTRIAL ENGINES
AND POWER UNITS



ENGINE SERIES		172 FOUR DIESEL	220 FOUR DIESEL	330 SIX DIESEL
Basic Model		DD	X	Y
Type		4-Cyl. O.H. Valve	4-Cyl. Diesel	6-Cyl. Diesel
Bore and Stroke—Inches		3.9 x 3.6	3.94 x 4.52	3.94 x 4.52
Displacement—Cubic Inches		172	220	330
Brake Horsepower	Dynamometer	59 @ 2400	60 @ 2250	96 @ 2250
	80% Dyn. BHP	47 @ 2400	48 @ 2250	77 @ 2250
Torque	Dynamometer	140# @ 1200	151# @ 1600	236# @ 1600
	80% Dyn. BHP	112# @ 1200	121# @ 1600	189# @ 1600
Compression Ratio		16.5 to 1	16 to 1	16 to 1



"SYSTEMATIC" BALANCE . . . the unicyclist's ability to achieve perfect balance is essential to the mastery of his art. So, too, does an air brake system require perfect balance if it is to achieve maximum efficiency. Because all Bendix-Westinghouse Air Brake components are designed and engineered to work together as a system, they provide the completely balanced operation that means more long-range safety, economy, and dependability. That's why these systems are first choice of the nation's fleet operators and vehicle manufacturers. Good reason for you to make it Air Brakes by Bendix-Westinghouse.

SPECIFY COMPLETE AIR BRAKE SYSTEMS BY

Bendix-Westinghouse





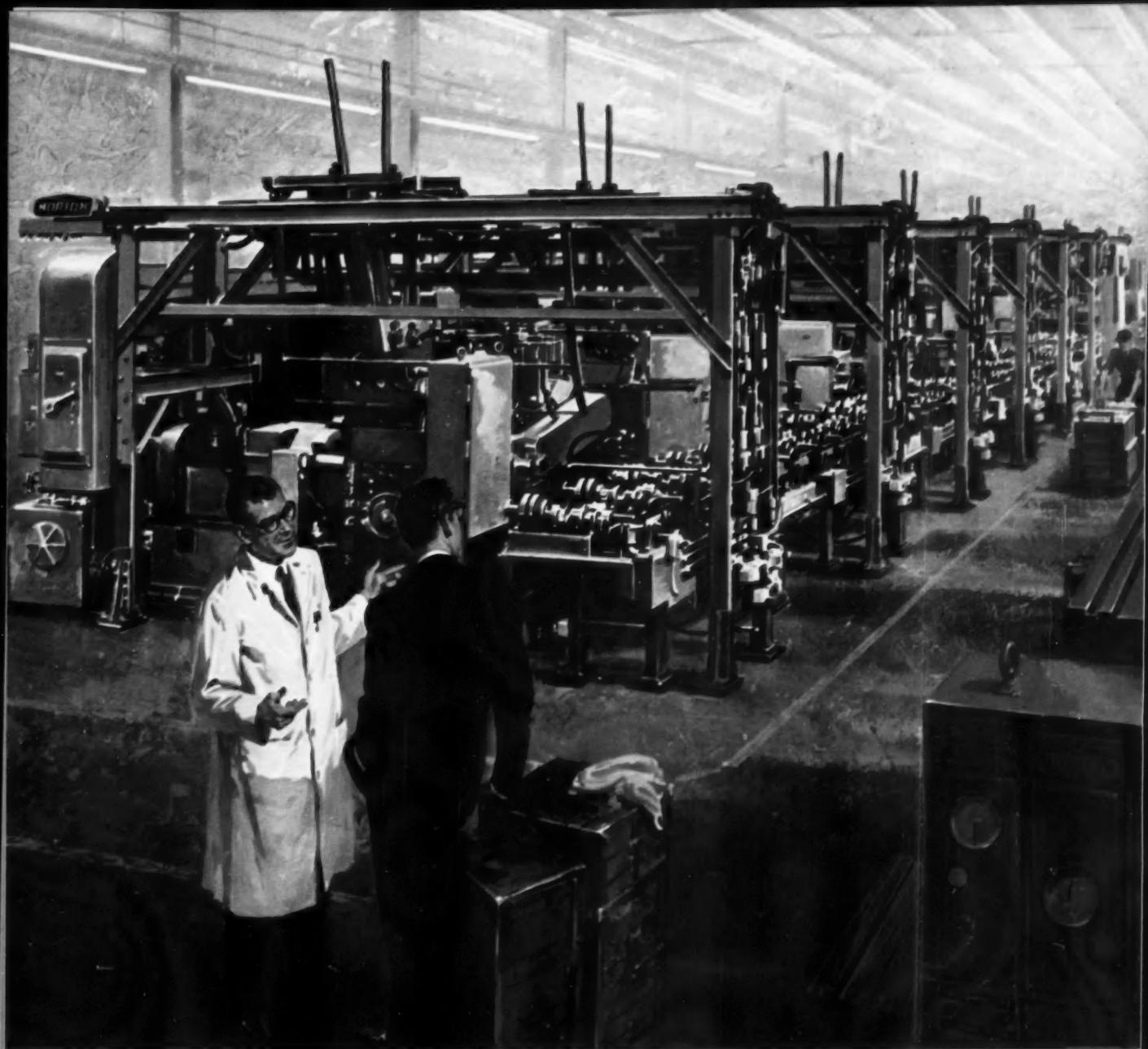
In nearly every field of business, there is one leader. And he becomes the leader for a very logical reason. Above everyone else, he offers more of what the customer wants. The leader in air brake systems—as it has been for 37 years—is Bendix-Westinghouse. You have made this so by your acceptance of the facts that Bendix-Westinghouse offers... **∞ MORE** experience—over 2,200,000 compressors built since 1923. **∞ MORE** research—millions of engineering dollars invested to produce new developments and contributions to safer, more dependable braking. **∞ MORE** service outlets—a nation-wide network of 450 Bendix-Westinghouse distributors complementing thousands of truck dealers ready to serve truck operators wherever their rigs may be traveling. **∞ MORE** complete line—in fact, the most complete line in the industry, custom-designed and tailored to individual job requirements. **∞ MORE** acceptance—more trucks travel more miles with Bendix-Westinghouse Air Brakes than with all other air brakes combined. **∞ MORE** economy—low operating cost through built-in long life and low replacement cost with our Repair Exchange Service. **∞ MORE** satisfaction—because of top-quality system performance and longer service life. These are some of the reasons why, in air brake systems, it pays to specify the leader—Bendix-Westinghouse.

Bendix-Westinghouse

AUTOMOTIVE AIR BRAKE COMPANY

General offices and factory—Elyria, Ohio • Branches—Berkeley, Calif., and Oklahoma City, Okla.





And now . . .

Norton Automatic Transfer Machines Multiply the "Touch of Gold"

The new Norton Transfer Type Crankshaft Grinder is actually many cylindrical grinders in one . . . in which adjusting, controlling, gaging, transferring and all other manual operations have become fully automatic! Once again the Norton "Touch of Gold" aids in mass-producing . . .

swiftly, accurately, economically.

To the development of grinding machines — ranging from the smallest and simplest to the largest and most complicated — Norton brings the longest and broadest experience. See your Norton Man about putting this experience to work for you.

NORTON COMPANY, Machine Tool Division, Worcester 6, Mass.

NORTON
MACHINE TOOLS

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners



Presenting!

NATIONAL BUD UNITIZED

TRADE MARK

Flanges, if desired, are available to simplify positioning and removal



National BUD UNITIZED has integral wear ring presenting rubber surface to shaft. Wear ring turns with shaft, sealing lip is never exposed to damage, cannot score shaft.

A new unitized oil-seal-and-wear ring that eliminates:

SHAFT WEAR OR SCORING

SEPARATE METAL WEAR SLEEVES

EXPENSIVE SHAFT FINISHES

COSTLY SHAFT RE-MACHINING

SEALING LIP INSTALLATION DAMAGE

SPECIAL INSTALLATION PROCEDURES

New National BUD UNITIZED seals are now in production, in a limited range of sizes, for heavy oil and grease sealing applications — including truck, bus and tractor uses. Still newer BUD UNITIZED seals are on the way for higher speed automotive and similar uses.

Changing a National BUD UNITIZED oil seal automatically changes the wear sleeve — in one fast, simple operation. Since the seal has its own integral

wear ring, it is almost impossible to install it other than squarely on the shaft. Expensive shaft finishing is no longer a necessity, nor is leakage under a metal wear ring a problem — both thanks to the rubber surface BUD UNITIZED presents to the shaft.

For complete details or skilled engineering help on application of BUD UNITIZED seals, write direct, or call your National Seal Applications Engineer. You'll find him in the Yellow Pages, under Oil Seals.

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.

General Offices: Redwood City, California

Plants: Van Wert, Ohio, Redwood City
and Downey, California



6013-R

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Circle 132 on Inquiry Card for more data

NEWS

Vol. 122, No. 12

June 15, 1960

'62 Models to Be Smaller Pontiac, Mercury, Dart, Plymouth to Shrink

By Hugh C. Quinn, Detroit Regional Editor
and C. B. Campbell, News Editor

The invasion of the lower end of the automobile market is just getting up steam. The compacts play only a small part in the over-all assault on the stronghold of the traditional low-priced three. Now the standard lines are getting smaller.

By the 1962 model year, which is less than 18 months away, nearly every U. S. automobile manufacturer will be offering cars that are smaller than current models—and this does not count the compacts.

As a result, "compact" is becoming a relative adjective which eventually will mean "smaller, but not MUCH smaller, than some other car, which ITSELF is rather small." Not exactly a dictionary definition, but it should fit the situation.

Not Exclusive Now

The downward move, or scaling down in price and size, started when Lark joined Rambler in the then-exclusive compact club and gathered momentum with the in-

roduction of Corvair, Falcon, Valiant and Comet. Still to come are the Buick Special, Oldsmobile F-85, Pontiac Tempest and Dodge Lancer.

And farther down the road is Ford's Cardinal, a 96-in. wheelbase,

four-passenger vehicle expected in 1962. Call this one a compact-compact, or a small-small car, or perhaps a minicar.

All of these are completely new cars brought out to supplement the standard offerings of the various passenger car divisions. But another phase of the "small" trend is fast developing, and this one does not fit into either the compact or minicar category.

This is the trimming down, in both size and price, of the standard, well-established car lines. Dodge Div. began last fall with introduction of the smaller but NOT compact Dart, which now accounts for four-fifths of all Dodge sales. When the Lancer is introduced in the fall, Dodge will drop one of its two bigger series, and the other will be discontinued in 1962.

Dart-Plymouth Shell

But Dodge will go a step further in '62. Along with Plymouth, the car will be smaller than the current 118-in. wheelbase model. Dart and Plymouth will share a new body shell that year, built with a 115-in. wheelbase and 72 in. wide.

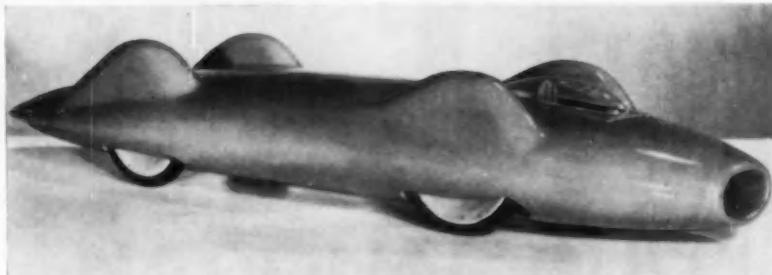
The result will be a squeeze on the Lancer by the new Dart and a similar squeeze on Valiant by the smaller Plymouth. So Dodge, once a big, heavy, medium-priced car, will be even smaller and lighter than today's Plymouth.

The same thing will happen next fall at Pontiac and Mercury. Pon-



Brig. Gen. Frederick Thorlin has been named commanding general of the Ordnance Tank-Automotive Command in Detroit.

BLUEBIRD TO TRY FOR NEW LAND SPEED MARK



Model of racer in which Donald Campbell of England will attempt to exceed 400 mph to top world's land speed record in September at Bonneville Salt Flats, Utah. It is powered by Bristol-Siddeley Proteus gas turbine engine.

tac is planning to shorten its wheelbase and length for '61, with wheelbases of 119 in. and 123 in. This will put Pontiac right in the middle of the scramble among Ford, Chevrolet, Plymouth, Dart and, to some extent, Mercury. And it will bring the Catalina and Ventura closer in size and price to the compact Tempest.

Mercury, built on the same body shell and wheelbase as Ford, will be a smaller car in '61 (see AI, March 15). This will narrow the price gap between Mercury and Ford, and also between Mercury and Comet.

Small Luxury Car

As reported in AI April 15, General Motors will make its cars lighter and narrower in '61, and new unitized bodies in '62 might find still further changes in general

dimensions. A new sports-type car in the works at GM, ostensibly for Cadillac, will be in the same general size and price group with the Thunderbird. This would constitute a small, luxury car—or at least a luxury car smaller than current Cadillacs.

Speculation that Buick will build this car, instead of Cadillac, indicates that Buick dealers also might get crack at selling the new model, which is now slated for '62 introduction.

A smaller Lincoln-Continental in 1961, and perhaps a slightly shorter Chrysler-Imperial combination in 1962 or 1963, would fit right in with the general trend. Imperial will be built on the unitized Chrysler shell beginning in '62, with a completely new body planned for both, probably in '63.

RCA, GM Demonstrate Electronic Highway

An electronic highway and automatic pilot for automobiles have been demonstrated by Radio Corp. of America and General Motors engineers.

Two specially equipped cars were guided automatically around a test track at the David Sarnoff Research Center, Princeton, N. J. Acceleration, braking and maintaining safe distances between each other were in response to electrical signals from the road.

The system combined for the first time the electronic vehicle detection and guidance system developed by RCA and car control equipment developed by General

Motors to respond to signals from the RCA road circuits.

The RCA system includes a series of car-length rectangular wire loops and a continuous guidance cable buried just beneath the pavement, and a chain of transistorized detector circuits along the roadway, each linked to one of the buried loops. Passage of a car over a loop causes a change in current which is detected by the transistorized unit and translated into an electrical signal. The guidance cable generates a steady signal at a different frequency to guide the auto along the center of its traffic lane.

Industry Beginning Summer Phase Out

With summer coming on, the automobile industry is beginning to slow down for model changeovers. Some manufacturing operations already have been cut back and will be halted within the next two weeks. Final assembly will start to phase out beginning the second week in July, with some lines still going close to Labor Day.

All introductions of 1961 models will be completed by the second week in October, with a few early birds making their appearance in late September.

Chrysler Corp. assembly lines will shut down beginning July 15, with the balance of the lines cutting off the following week. All plants will be back in operation by the first week in August, with the possible exception of Imperial, which has been working one week on, one week off, for the last several weeks.

GM lines will begin to shut down the middle of August and will not start up until after Labor Day. Buick, however, may schedule some short weeks (four days) during July to taper off production slowly.

Ford is scheduling some new production for July and August. The Kansas City plant will begin building Comets July 11, and 7000 units are scheduled for the balance of July and the month of August.

Named to AMA Post

William C. Flaherty, business research director, Chrysler Corp., has been elected chairman, Highway Economics Research Committee, Automobile Manufacturers Association.

NEWS

CONTINUED

GM of Canada Plans To Make Own Compact

General Motors of Canada will strike out on its own with a "strictly Canadian" compact car for '61 called the Invader. The Canadian firm also will offer the three new B-O-P compacts, the Buick Special, Oldsmobile F-85 and Pontiac Tempest.

These new models, along with Corvair, now on the market, will give GM the distinction of having more compacts than any other maker. Invader probably will be a styling re-do of one of the other new compacts, perhaps Buick, in much the same way that Canadian Pontiac is in reality a Chevrolet with Pontiac sheet metal front and rear.

Invader will be made in Canada, but the Tempest, F-85 and Special might be imported from the U. S. This would make the Invader a high volume seller because of its relatively lower price as a Canadian domestic automobile.

Brucker to Supervise Automotive Program

Designation of Army Secretary Wilber M. Brucker as single manager for automotive supplies and for construction of supplies has been announced by Secretary of Defense Thomas S. Gates, Jr.

Under the assignment, the Army will provide all military services with military automotive supplies which include such items as vehicular supplies and repair parts, tires and tubes, engine supplies, diesel engines and components. Agencies to carry out these assignments will become fully operational as soon in June as possible.

The Army will be charged with

complete responsibility for wholesale supply of the armed forces in their respective commodity areas. This includes responsibility for deciding what will be bought, purchased, cataloging, standardizing, distributing, and disposing of excess items.

New Light Engine Announced by I-H

International Harvester has announced a new lightweight Diesel engine for use in the medium-duty B-160 and BC-160 International truck series. The new six-cylinder power plant, designated D-301, weighs 902 lb and delivers 110 hp at 3000 rpm. Displacement is 301 cu in., with bore and stroke of 3.812 x 4.390 in., and compression ratio of 18 to one.

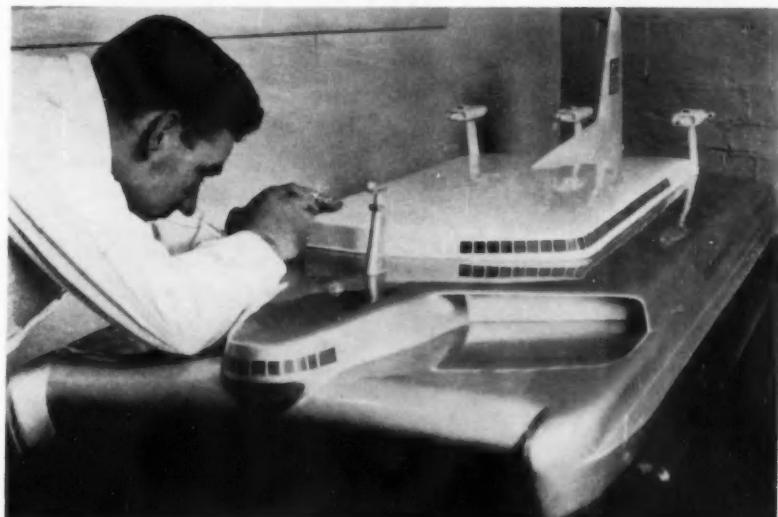
Auto Show Dinner To Hear Eisenhower

President Eisenhower will address the traditional "blue ribbon" dinner of the 43rd National Automobile Show on Oct. 17 in Detroit. He will speak at a black-tie gathering of more than 2500 civic leaders, government officials and captains of industry, automobile and otherwise.

The banquet, as well as the show, will be held in the new Cobo Hall overlooking the Detroit River. The show will open Oct. 15 for a nine-day run, and will feature all 1961 U. S. passenger cars and trucks as well as foreign cars.

Speaker at the last national show was Vice President Richard M. Nixon. Only other chief executive to speak at the show banquet was Herbert Hoover in 1931.

AIR-CUSHIONED CHANNEL TRAVEL



Workman inspects model of hovercraft for skimming across English Channel with 300 passengers and 30 tons of freight. The model is being shown at British Exhibition in New York City's Coliseum. Planners say craft will travel at 90 knots on cushion of compressed air.

NEWS

CONTINUED

SAE's January Parley To Be Its Biggest

The Society of Automotive Engineers is scheduling its biggest meeting ever for January, 1961, in Detroit's Cobo Hall. Harry E. Chesebrough, SAE president, says more than 15,000 engineers are expected for the society's International Congress and Exposition Jan. 9-13.

Chesebrough says the Congress and Exposition will bring together, in one place and at one time, the key engineers from the entire world to present a "look into the crystal ball of automotive engineering for the era ahead."

The conclave, planned around the theme "Breakthroughs in the '60s," already is scheduling more than 60

technical sessions with more than 150 papers and 500 displays. A special science pavilion will feature such exhibits as the X-15 experimental aircraft, new wheel-less vehicles, engines with no moving parts, and other late technical developments.

Paul C. Ackerman, Chrysler Corp. vice president of engineering, will be chairman of the Operating Committee for the International Congress.

Foundrymen Elect

John E. McIntyre, vice president and general manager, Sibley Machine and Foundry Corp., South Bend, Ind., has been elected vice president of Gray Iron Founders' Society, Inc.

WHITE ENTERS MULTI-STOP DELIVERY TRUCK FIELD



Fiberglass roof with translucent skylight, fiberglass side panels and unit body are features of new White truck. White is offering five basic models and will add five more later in the year as dealer expansion progresses.

Roche Heads GM Distribution Staff

James M. Roche, former general manager of Cadillac Div., has been named vice president in charge of the distribution staff for General Motors. He succeeds William F. Hufstader, who retires June 30.

Roche, who became a GM vice president when he took over the top job at Cadillac in 1957, now directs distribution and sales policies for the corporation, as well as dealer relations activities and training centers. He joined Cadillac in 1927 as a statistician in the Chicago branch, worked up through business management, personnel and public relations. In 1950 he became general sales manager of the division.

Roche is succeeded at Cadillac by Harold G. Warner, works manager since 1955. He joined Cadillac on the assembly line in 1927 and worked up through the plant to become works manager.

Hafstader headed the distribution staff since November, 1948. He began his GM career in 1929 as used car manager for Buick, later became general sales manager for that division. Previously, he had worked for Pierce-Arrow, Dort, Mason, Graham, and Dodge. Robert J. Ackerman, assistant works manager since 1955, succeeds Warner as works manager.

Chrysler Institute Has 65 Graduates

The Chrysler Institute of Engineering granted Master of Automotive Engineering degrees to 65 members of the 1960 class at June 9 commencement exercises in Detroit. Degrees were presented by George J. Huebner, Jr., executive engineer in charge of research in Chrysler's Engineering Div., who took over this month as president of the institute.

Members of the graduating class came from 23 states and five foreign countries. Also honored were 43 Detroit-area Chrysler employees who completed night school courses in science, mechanical drawing, metallurgical technology, body drafting and chemical technology.



NOW-A TWIN RING THAT CUTS PISTON HEIGHT UP TO $\frac{1}{4}$ "

Perfect Circle's newest development in piston ring design

Now, by combining the intermediate compression ring and oil ring, Perfect Circle makes possible a reduction of up to a full $\frac{1}{4}$ " off piston and engine block height. And, the new Perfect Circle "101" Twin-Ring cuts piston weight, as well as total engine weight. By reducing the total number of ring elements per piston, it also reduces total ring friction up to 10%.

These advantages are obtained without sacrificing either oil control or compression seal. And, the new Perfect Circle "101" Twin-Ring is easily adaptable to current production assembly methods and equipment.

This new development—another Perfect Circle "first"—opens new areas for piston design. Full information for specific applications furnished on request.



PERFECT CIRCLE

PISTON RINGS • PRECISION CASTINGS • POWER SERVICE PRODUCTS • SPEEDOSTAT
HAGERSTOWN, INDIANA • DON MILLS, ONTARIO, CANADA



Timing gears made of CDF Celoron will not pick up and amplify sound due to Celoron's naturally low tone frequency. Tests show that Celoron gears reduce noise by up to 50% compared to all-metal gear sets!

Made of quality controlled, fabric reinforced phenolic resin, Celoron® high-impact gears are constantly replacing metal in critical areas ranging from earth-moving machinery to compact cars to movie projectors.

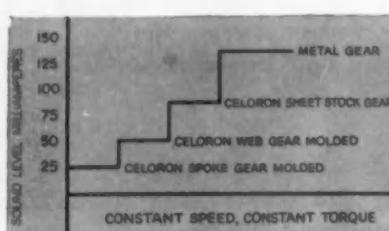
Celoron molded materials are only one family of products from industry's largest selection of

non-metallic structural and electrical materials . . . including thermosetting laminates, vulcanized fibre, silicone rubber, and mica.

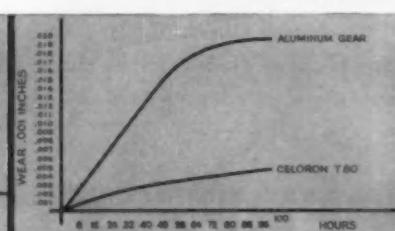
This wide choice gives you every assurance of meeting your exact quality and cost needs in plastic material. Refer to Sweets PD file or write to us for the latest Celoron catalog.



CONTINENTAL-DIAMOND FIBRE
A SUBSIDIARY OF THE **Baile Company** • NEWARK 2, DEL.
In Canada, 46 Hollinger Road, Toronto 16, Ont.



Low sound level of Celoron is shown by this graph which compares metal to the different types of Celoron gears.



Long wearing characteristics of Celoron gears are here contrasted to the shorter life spans of metal-made gears.



Quality control of Celoron gears is assured by special testing machines such as this in CDF laboratories.

When They Compare for

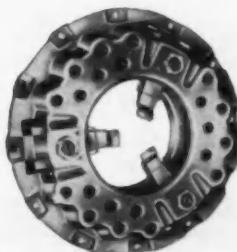
Clutch Torque Retention

...Fleet Operators Switch to LIPE!



Torque retention is an important matter to the steadily growing body of fleet owners who are changing over to Lipe. Their every-day experience tells them that Lipe Heavy-Duty Clutches mean *more* miles per gallon of fuel . . . *more* ton-miles between shop-stops . . . *more* capital-equipment-use

per repair dollar. All because of Lipe's high retention of torque capacity. Why argue with these practical men? Give them what they want: Lipe Heavy-Duty Clutches, either as original or optional equipment. Let their growing numbers prove to you that *the trend is to LIPE!*

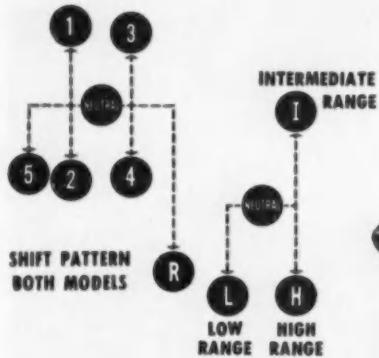


Lipe Heavy-Duty DPB Clutches are available in single and two-plate types; 12", 13", 14" and 15" sizes; with torque capacities from 300 to 1900 ft.-lbs.



NEW Heavy-Duty

10 closely-spaced gear splits plus deep reduction ratios



MODEL 15-G-1120

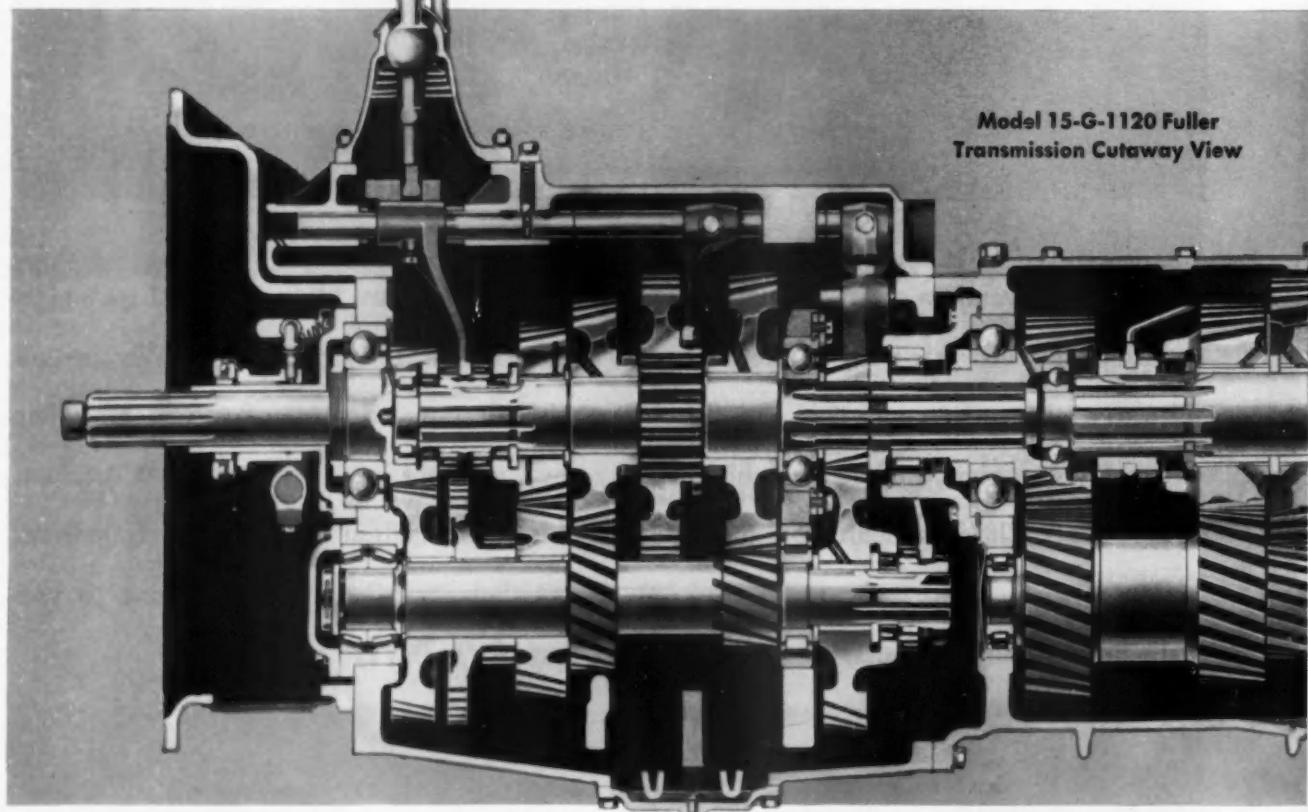
MODEL 15-H-1120

Fuller now offers two new 15-speed transmissions engineered for on and off-highway diesel truck operations demanding high capacity, long wear life and ease of operation . . . for logging, mining, construction, oil-

field work, aggregates and ready-mix.

Advantages of the new transmissions include:

1. Extremely short installation dimension, which permits shorter wheelbase for tractors which formerly incorporated main and auxiliary transmissions.
2. Maximum operational flexibility with not only 10 closely-spaced gear splits, but also 5 speeds avail-



Model 15-G-1120 Fuller
Transmission Cutaway View

FULLER

TRANSMISSION DIVISION
MANUFACTURING COMPANY
KALAMAZOO, MICHIGAN

Unit Drop Forge Div., Milwaukee 1, Wis. • Skelar Auto Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Calif. and Southwest Dist. Office, Tulsa 3, Okla.
Automotive Products Company, Ltd., Automotive House, Great Portland Street, London W.1, England, European Representative

15-SPEED TRANSMISSIONS

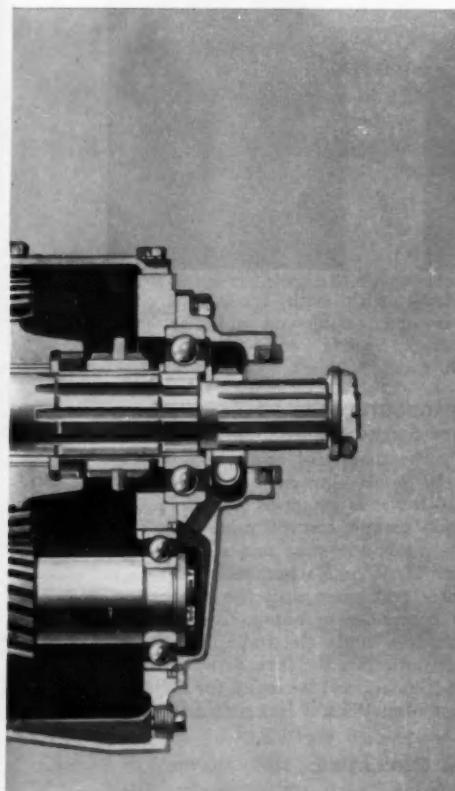
designed for combination on and off-highway applications

able for low range operation through a deep reduction in the auxiliary.

3. A wide choice of optional gear ratios to match every job requirement.

4. Weight reduction obtained by eliminating support brackets, joints, cross members and a propeller shaft.

For full details on the Fuller 15-G-1120 and 15-H-1120 Transmissions, ask your dealer or write Fuller Manufacturing Company.



Subsidiary of EATON
Manufacturing Company

Model 15-G-1120: Standard Gear Ratios

Speed	SPLITS—OVER-HIGHWAY			LOW RANGE—OFF-HIGHWAY		
	Split	Ratio	% Step	Speed	Ratio	% Step
10th	O'Drive-High	.636	33	5th-Low	1.33	
9th	O'Drive-Int.	.844	19			57
8th	Direct-High	1.00	33	4th-Low	2.09	
7th	Direct-Int.	1.327	32			76
6th	3rd-High	1.76	33	3rd-Low	3.68	
5th	3rd-Int.	2.32	41			86
4th	2nd-High	3.27	33	2nd-Low	6.83	
3rd	2nd-Int.	4.33	51			100
2nd	1st-High	6.54	33	1st-Low	13.67	
1st	1st-Int.	8.68				

Model 15-H-1120: Standard Gear Ratios

Speed	SPLITS—OVER-HIGHWAY			LOW RANGE—OFF-HIGHWAY		
	Split	Ratio	% Step	Speed	Ratio	% Step
10th	O'Drive-High	.636	33	5th-Low	1.68	
9th	O'Drive-Int.	.844	19			57
8th	Direct-High	1.00	33	4th-Low	2.64	
7th	Direct-Int.	1.327	32			76
6th	3rd-High	1.76	33	3rd-Low	4.65	
5th	3rd-Int.	2.32	41			86
4th	2nd-High	3.27	33	2nd-Low	8.63	
3rd	2nd-Int.	4.33	51			100
2nd	1st-High	6.54	33	1st-Low	17.27	
1st	1st-Int.	8.68				

Optional Gear Ratios: Models 15-G-1120, 15-H-1120

Overdrive: .85, optional at extra cost
Overdrive: .74
Reverse: 5.06

CLECOMATIC

the automatic torque control tools
that made industry stop, look
and examine their methods
of setting screws, nuts,
and bolts.



Cleomatic No. 10 Series
Screwdriver-Nut-Runner



Cleomatic Right Angle Nut-Runner

Cleomatic[®] No. 10 Series Screwdriver—Nut-Runner: These are the tools that enable you to set torque to the most critical specifications . . . then forget it. Torque is positively maintained by a no-drift locking device. A long wearing, non-friction clutch is quickly adjusted when torque change is desired. *This is the only torque control air tool that starts and stops automatically!* Operator merely engages the screw with bit, the tool starts. When torque is reached, the tool stops. Motor operates only during rundown. Less air is used. Wear is reduced. There is no quality let-down at the end of a shift because control is in the tool. This tool has little impact, is shorter, and weighs less than competitive tools. No. 10 Cleomatic Screwdriver—Nut-Runners are available in pistol grip or straight handles in speeds

from 400 to 2,900 r.p.m. Reversible or non-reversible.

Cleomatic Right Angle Nut-Runners: You get uniform tightness in every nut or bolt rundown with a Cleomatic 14 or 16 Series Nut-Runner. Torque is preset. When specified foot pounds are reached, air is automatically shut-off at the driving spindle. The hazardous, tiring torque kick usually found in tools of this type is substantially reduced, your operators can produce more without extra effort. As for maintenance, there's practically none. Cleco's non-friction clutch operates for very long periods, completely maintenance free. Torque adjustment is made externally, no need to disassemble the tool. Cleomatic Nut-Runners are

available with both recessed socket heads and double-end spindles (reversible). Speeds range from 250 to 1,000 r.p.m.

IN PRODUCTION NOW! Cleomatic No. 6 Series Screwdriver—Nut-Runners: Essentially the same tool as the Cleomatic No. 10 Series—but smaller and lighter. No. 6 Series is equipped with the same unique torque control principle. The same automatic start and stop mechanism. They enable you to make even greater cost savings in the production line operations of automotive, aircraft, appliance, and electronic industries. Cleomatic No. 6 Series Screwdriver—Nut-Runners will be ready for delivery about May 1960.

To find out how big an improvement a Cleomatic can make in your operation, call your local Cleco[®] representative for a tryout-demonstration. For detailed literature, write:



A Division of REED ROLLER BIT COMPANY
P. O. BOX 2119 • HOUSTON 1, TEXAS

IN CANADA: Cleco Pneumatic Tool Company of Canada, Ltd.
927 Millwood Road, Leaside (Toronto), Ontario

*Trademark

NEWS

FEATURES

Tires Decide '500' Victor 7 Drivers Top Ward's '59 Average Speed

By Bill Smyth
Track and Race Editor

When two almost identical cars are driven by two nearly equal drivers, who are backed by two of the best pit crews, they should, in theory, finish together. But with all the variables that exist in the Indianapolis 500-Mile Race, the chances for the theoretical to be proven in practice are extremely remote. Yet in the 1960 classic the theory was proven.

Jim Rathmann of Miami, Fla., scored a popular victory in the 1960 sweepstakes, but only after engaging in a red hot duel with the defending champion, Rodger Ward of Indianapolis, for almost 250 miles.

7 Exceed '59 Mark

Last year's record average speed of 135.857 mph set by Ward was exceeded by the first seven finishers.

Rathmann and Ward started side-by-side in the front row and 197 laps or 492 miles later they were still wheel to wheel. This was a fantastic contest that topped anything ever seen in racing and will be a conversation piece for many years.

Compare the drivers. Ward has been a race driver for 14 years. During his career, he has won 12

national championship races, including the 1959 Indianapolis event. As the 1959 national champion, he is at his peak.

Rathmann also has been racing for 14 years. He has won only three national championship races, but he was the victor at Monza in the fastest 500-mile race ever run in 1958.

He drove the fastest race in history in winning a 100-mile event

OFFICIAL TIMES AT INDIANAPOLIS

The 13 drivers who completed the Indianapolis 500-mile race, and their official times, follow:

Driver	Time	Average
Jim Rathmann	3:36:11.36	130.767
Rodger Ward	3:36:24.03	130.631
Paul Goldsmith	3:39:16.56	136.792
Don Branson	3:39:19.26	136.795
Johnny Thomson	3:39:22.65	136.750
Eddie Johnson	3:40:21.88	136.137
Lloyd Ruby	3:40:36.88	135.983
Bob Veith	3:41:28.78	135.452
Bud Tingelstad	3:44:21.17	133.717
Bob Christie	3:44:51.54	133.416
Red Amick	3:47:21.93	131.946
Duane Carter	3:47:28.53	131.682
Bill Homier	3:48:22.00	131.387

at Daytona Beach in 1959 at an average speed of 170.261 mph.

While prior to 1960, he had never won an Indianapolis race, second place finishes in 1952, 1957 and 1959 have to add up to something.

Veteran observers ranked Ward and Rathmann as the favorites at Indianapolis for the last two years. Two drivers can never be equal, but these two come as close to equality in ability as is possible.

Compare the car. Both are new and both were built by A. J. Watson, acclaimed as the genius of Indianapolis. Watson has been the winning mechanic three times, in 1955, 1956 and 1959. In the latter two years, he built the winning machines. For the past two years, he has been the most sought after builder in racing.

Eleven cars entered in 1960 bore his stamp and all 11 qualified for the race. The qualification track records were broken three times and every time it was a Watson chassis that did it. The first six qualified cars were all Watsons.

Watson Was Mechanic

Ward's car, the Leader Card 500 owned by Robert C. Wilke of Milwaukee, Wis., had Watson as the chief mechanic. Rathmann's mount, the Ken-Paul Special owned by Ken Rich and Paul Lacey of Dallas, Tex., was prepared by Chick Hirschman.

While two cars can never be equal, these two come as close as is possible. The stage was set for the most dramatic "500" of all time.

(Turn to page 49, please)

AI TABLOID

Highly resistant coatings, both hard and anti-oxidizing, are produced by the application of chromium carbide, titanium carbide, tungsten carbide and chromium boride by metalizing or flame spraying methods.

Closed hopper cars for the bulk rail shipments of pellets of plastic raw material are unloaded into storage silos by a vacuum system in a small fraction of the time required for customary unloading methods.

Graphite electrodes of extreme purity are reported to be produced better and cheaper by a new method based on the decomposition of cyanogen gas instead of the present higher temperature graphitizing process.

A fertilizing solution as a by-product of wood pulp may solve the pulp industry's stream pollution problems if tests under way prove successful. A new process employs nitric acid and ammonia as pulping reagents.

Dicalcium silicate, a by-product of metallurgical electric furnaces, is proving highly effective as a soil-liming material, better even than crushed limestone.

An architectural highlight of the "Golden Sixties" may be just that, gold applied in solution as a coating on customary building materials and subsequent firing to make it permanent.

Corporate profits were only slightly changed in the closing quarter of 1959 from the preceding quarter and the total for the year was a record high of \$48 billion before taxes, the U. S. Department of Commerce reported. The 1959 profits total was \$10 billion above the recession level of 1958 and \$4 billion above that of 1955, the best previous year. Profits after taxes rose to \$24.5 billion from \$19 billion in the previous year.

A vane type oscillating compressor suitable for use where unit weight is a major consideration has been proved feasible, according to a design study by the University of Oklahoma Research Institute for the Army Transportation Corps. The report analyzes the vane type compressor in comparison with the best available lightweight centrifugal compressor. Studies show that for a given pressure ratio and mass flow, the vane type compressor is far superior in displacement as well as weight saving.

A new electronic method to control lighting automatically according to the density of the negative greatly improves photo printing by bringing out all the details of the original negative in the print.

Dissolved iron and spent acid may be profitably recovered from waste pickle liquor of the steel industry by a newly devised process that prevents stream pollution.

Proper pre-treatment of polyethylene simplifies the problem of printing on it. Methods now used include chemical, flame and electronic treatments.

A comprehensive survey of government plastics research is available to industry and the public. Entitled *New Plastic Materials Through Government Research*, it encompasses, in a single volume, a review of all major plastics research conducted by various Federal agencies with scientific research programs.

Combination fuels containing boron and alkyl aluminum compounds could be injected into conventional hydrocarbon fuels to give existing jet and rocket engines added thrust and eliminate the need for ignition systems, according to Ethyl Corp. scientists. They say combination fuels containing self-igniting chemicals have been largely unexploited to date.



Franklin A. Miller

Franklin A. Miller Dies in Florida

Franklin A. Miller, retired director of marketing and merchandising for Raybestos-Manhattan, Inc., died May 18 at Fort Lauderdale, Fla. He was 72.

Mr. Miller, who lived at 720 Alter Rd., Detroit, retired in 1959. He was stricken while vacationing.

A nationally known authority in the automotive field, Mr. Miller had been manager of the Direct Mail Div. of the Chilton Co. before joining Raybestos - Manhattan. He served on many merchandising committees and was a director of the National Standard Parts Association, Brake Lining Manufacturers Association, and director and president of the Friction Materials Standards Institute. He also served on many important committees of the National Association of Manufacturers.

Surviving are his widow, Ann; a son, Franklin A., Jr., of Grosse Point, Mich., and a daughter, Mrs. Morris W. Baker, of Coytesville, N. J.

NEWS

FEATURES

CONTINUED

(Continued from page 47)

The start of the race was fairly slow and Ward jumped into the lead in the first turn. However, Eddie Sachs, the pole man, took first place on the second and third laps. Ward got the lead back on the fourth lap and held it until the 18th. Troy Ruttman, the 1952 winner, made his bid for some lap prize money on the 25th circuit. (At Indianapolis, the leader of each lap is paid \$150.)

Ward wrested the lead from Ruttman on the 38th lap, but Sachs was back in first on the 42nd. Ruttman took the lead on the 52nd. It was Sachs again on the 57th. Jim Rathmann put his car into the No. 1 position for the first time on the 62nd lap. He and Sachs exchanged the lead twice, before Johnny Thomson moved into the picture on the 86th lap for 10 laps. Rathmann led the next 27 laps and that was the longest time that anyone was able to keep the lead.

Ward Regains Lead

On the 123rd lap, Ward returned to first place and from there to the finish Rathmann and Ward were never more than seconds apart. They swapped the lead 14 times officially and several more times at other places than the starting line.

Ward was leading on the 196th lap and seemed to have a slight edge on speed on the long stretches. On the next lap Rathmann passed him and Ward immediately slowed perceptibly. Rathmann continued to increase his margin and at the finish had a 12.67 second edge. Ward's right front tire was almost worn out, when he dropped back. An examination after the race showed that he did not have one more fast lap left in the tire. Rathmann's tires were in similar shape, but with probably about two laps left.

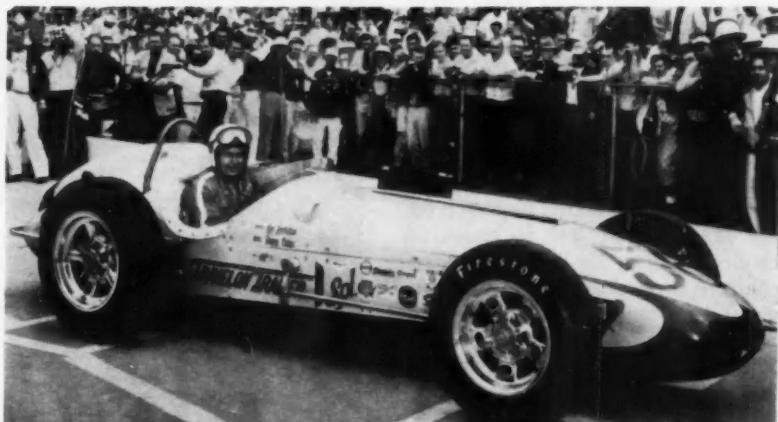
It was an average race as far as



Jim Rathmann, of Miami, Fla., roars across finish line to win Indianapolis race in record time. He was seconds ahead of Rodger Ward, 1959 victor.

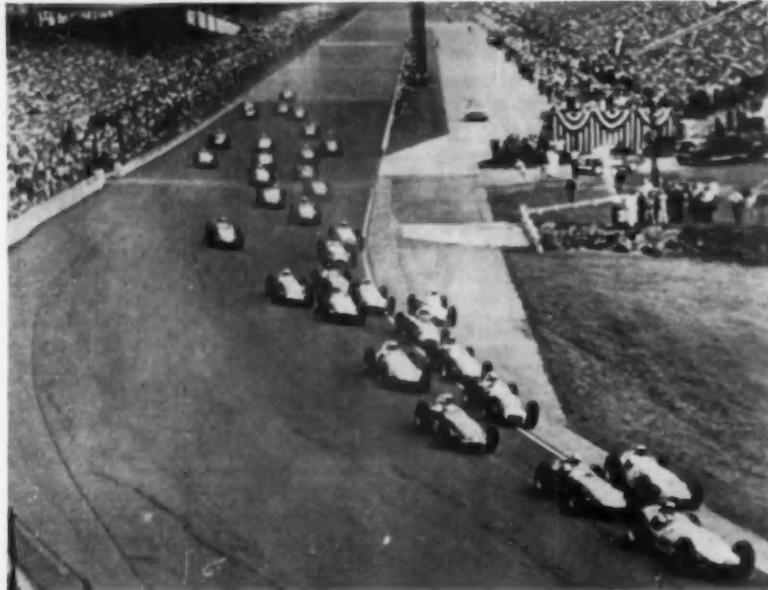


Rodger Ward (left) and Jim Rathmann, eventual winner, run side-by-side in straightaway. They took turns leading race before Rathmann won by seconds.



Jim Hurtubise, of Lennox, Calif., set four-lap average of 149.056 mph in qualifying runs. He went out with leaking oil line on 189th lap.

START OF INDIANAPOLIS RACE



The Nation's top racing drivers start 500-mile race at Indianapolis Speedway. This year's classic was one of the closest in the race's history.

mechanical ailments were concerned. Thirteen cars finished the 500 miles and three more were running at the finish. This is a normal number. On the other hand, only two cars were eliminated in crashes. Eddie Russo hit the wall in the southwest turn, when he wore out a right front tire. Wayne Weiler smacked the retainer on the same turn when a stabilizer broke and caused the chassis to shift and cut the side of his right rear tire.

28 Use Air Jacks

The pit stops were very fast again, with 28 of the 33 starters using some form of air jacks, which were introduced a year ago. These jacks are a simple piston mounted on the car. They are driven down when nitrogen under 350 lb pressure is applied. The car is elevated instantaneously.

One particular pit stop was very costly to Ward. He was leading the race when he made his first stop on the 42nd lap and had an excellent chance to keep the lead. His crew changed three tires and refueled in about 17 seconds, but as they were pushing him off, the engine died. This necessitated restarting, which is always difficult when the engine is hot. By the time Ward was back on the track, he had lost a full minute in the pits. He spent the

rest of the day trying to make up the lost time. With a clean pit stop, he undoubtedly could have finished the race before wearing out his last set of tires.

Mechanical reasons for elimination of other cars included clutch failure, broken connecting rod, broken fuel pump drive, broken rear axle gear, magneto failure, broken stabilizer, broken clutch, broken stud bolt, brake failure, and broken piston rings.

MECHANICS PREPARE FOR BIG RACE



Pit area at Indianapolis Speedway bustles with activity on Memorial Day as mechanics make last-minute adjustments to racing cars.

Canadian Plant Producing Trucks

Production of heavy diesel-powered trucks has started at Welland, Ont., by the newly formed Peninsula Truck Div., Switson Industries, Ltd.

The truck line is in addition to Switson's output of appliances and gas heaters. Laroche Hudson, president, says the concern plans to further diversify its products.

Truck production, he said, will consist principally of heavy-duty highway and off-the-road trucks in tilt-cab-over-engine style. They will be in the 60,000 to 90,000 lb weight class.

Douglas, GE Contract

Douglas Aircraft Co. will design and build five engine pods and stubs for the first General Electric aft-fan engines to power the Sud Aviation Caravelle. The \$2.1 million contract calls for Douglas to deliver pods, stubs and related equipment in November.

NEWS

FEATURES

CONTINUED

Ceramic to Protect '61 Rambler Exhausts

American Motors has borrowed from the aircraft industry a ceramic coating technique that will be introduced on 1961 Rambler exhaust systems.

E. W. Bernitt, vice president of automotive operations, said the new corrosion-resistant exhaust system should "largely eliminate" the need for replacement in normal car life.

"Tests show the ceramic coating to be fully resistant to emission acids, rust and salt," reports Mr. Bernitt, "indicating a durability far beyond that of present systems."

The system was developed jointly by AMC, Walker Manufacturing Co. of Racine, Wis., and Bettinger Corp. of Milford, Mass. The muffler and tailpipe are coated in a process that Bettinger originally conceived for military jet engines.

Mr. Bernitt says the ceramic is applied by dipping mufflers and tailpipes so that both outer and inner surfaces are coated. The coating then is fused to the metal in a continuous furnace at a temperature of 1500 F. Finally, a layer of asbestos insulation and the zinc-coated outer cover are applied.

De-Emphasis of Fins Expected in '61

Fins will be de-emphasized in 1961. Cadillac and Plymouth, the two passenger cars with the largest fins on current models, are backing off next year. Cadillac still will have fins, but they will be trimmed down from their present stature.

Plymouth will do away with the fins altogether, offering a rounded rear-end treatment more conservative than the current theme. The fins helped Plymouth, and other

CHRYSLER TROUBLE SHOOTING WINNERS



Philadelphia area student champions are awarded trophies after diagnosing and repairing 20 malfunctions set up by Plymouth experts. From left are George Gorson, chairman of dealer committee sponsoring competition; J. G. McMonigle, George Cutler, Plymouth Director of Services, and R. Daliessio. McMonigle and Daliessio are students at Ridley Township High School.

Chrysler Corp. cars, with the 1957 "Forward Look," but sales officials feel it is time for another change.

Early rumors are that the '61 Plymouth will have a single fin down the center of the rear deck lid, patterned after the off-center fin of the XNR experimental Plymouth.

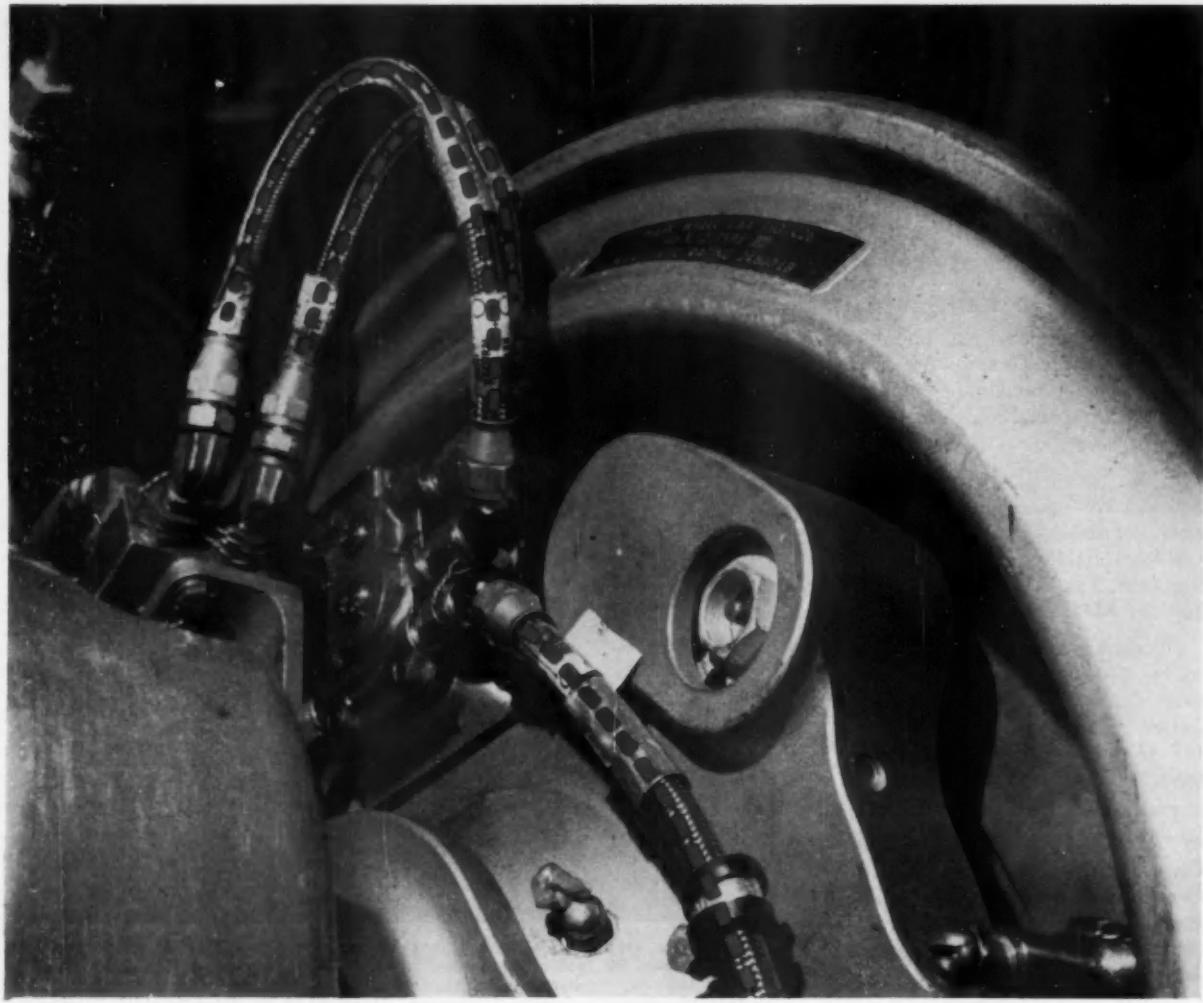
Falcon Output Boosted

Ford has added a second shift for Falcon production at the Metuchen, N. J. assembly plant. The 10 per cent increase in output boosts the annual production rate for Falcon to 600,000 units. Plants at Lorain, O. and Kansas City, Mo. have been working two shifts, and the San Jose plant is on a single shift.

Engine Congress To Meet in 1962

The International Congress on Combustion Engines will meet in Copenhagen, Denmark, in June, 1962. Its theme will be "Recent Developments With Diesel Engines and Gas Turbines Above 3000 Horsepower and With Gas Engines Above 1500 Horsepower."

Individuals interested in presenting a paper at the meeting may submit a resume to the U. S. National Committee before Dec. 15, 1960. The resume, not to exceed two typed pages, must include a list of anticipated figures, graphs and tables. Other information may be obtained by writing to Robert L. Stanley, secretary of the U. S. National Committee, 2000 K St., N. W., Washington 6, D. C.



Hydraulic anti-skid brake system uses hose lined with TEFLON® for utmost reliability

The ever-present problems of handling fuels, oils and corrosive hydraulic fluids at high temperatures and pressures call for hose lines with exceptional performance and durability. Hoses lined with Du Pont TEFLON TFE fluorocarbon resins are employed throughout a new commercial cargo plane, for example, to insure the utmost reliability under exacting service conditions. Shown above are hose lines to the hydraulic anti-skid brake system operating at 1,750 psi. In addition to these fluid power lines, other hoses lined with TEFLON TFE resins handle oils and fuels at temperatures to 200°F. and pressures up to 3,000 psi.

In automotive applications as well, hose lined with Du Pont TEFLON resins offers complete resistance to

virtually all chemicals encountered . . . exceptional durability under continuous flexing, including torque stress and vibration . . . makes possible space savings by the use of smaller outside diameter hose. TEFLON TFE resins are rated for continuous use up to 500°F.

New constructions include fiber reinforcements, elastomeric coverings, convoluted tubing of TEFLON for greater flexibility and a variety of industrial couplings. For more details on properties and performance, consult your hose supplier, or write to: E. I. du Pont de Nemours & Co. (Inc.), Polymers Department T-5-615, Room 2526, Nemours Building, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.



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'TEFLON is DuPont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resin.

MEN IN THE NEWS



American Motors Corp. — William S. Pickett has been named director of automotive export.



Electric Autolite Co., Wire, Cable and Industrial Instrument Divs.—Kenneth L. Gackel has been appointed sales manager.



Aluminum Co. of America — George E. Herrmann has been appointed manager of transportation sales.



Pioneer Engineering & Mfg. Co., Wettlauer Body Engineering Div.—E. J. Cloutier has been appointed sales manager.



Metal & Thermite Corp., Welding Products Div.—Otis H. Young has been named manager of west-central area.



Cessna Aircraft Co.—Vincent E. Moore has been promoted to secretary of the company.

General Motors Corp., Chevrolet Motor Div.—Frank D. Brush was named Portland, Ore., zone manager; E. A. Snyder was named South Bend, Ind., zone manager, and V. P. Whetstone was appointed Seattle, Wash., zone manager.

Chrysler Corp.—John D. Moran was appointed director of administration purchasing and Richard D. Morrison was named purchasing agent for materials and services.

General Motors Corp., Fisher Body Div.—William E. Sehn has been appointed director of reliability.

Electric Autolite Co., Battery Div.—William C. Ray has been named general manager.

Racine Hydraulics & Machinery, Inc.—Russ A. Henke has been appointed director of research.

Bell Aircraft Corp., Niagara Frontier Div.—Bruce McKay has been named assistant vice president for marketing.

Ford Motor Co., Lincoln-Mercury Div.—Paul B. Hoffman has been appointed parts and service marketing manager.

National Lead Co., Doehler-Jarvis Div.—Claude E. Robitaille has been appointed works manager at Grand Rapids, Mich., plant; R. E. Moesser has been named plant controller at Toledo Plant 2, and R. Gordon Roesler has been promoted to assistant sales manager at Pottstown.

Pittsburgh Plate Glass Co., Glass Div.—William F. Galey has been appointed research manager; Fred R. Hohmann has been named assistant research director, and Joseph A. Gullatta has been appointed process engineering manager.

Studebaker-Packard Corp.—Cleve R. Foster has been appointed Detroit zone sales manager.

Gabriel Co., Gabriel Electronics Div.—James R. Wescott has been appointed vice president-marketing.

Divco-Wayne Corp.—Harold Stream has been appointed financial vice president and secretary.

Hughes Aircraft Co.—Charles B. Heustis has been appointed treasurer.

U. N. Alloy Steel Corp., Hot Work Tool Steel Div.—Richard L. Duncan has been appointed product manager.

General Motors Corp., Chevrolet Motor Div.—Lawrence H. Averill has been promoted to executive assistant general sales manager; Herman P. Sattler has been named assistant general sales manager for the eastern half of the U. S.; James E. Conlan has been promoted from manager of Truck Dept. to assistant general sales manager, and Albert P. Olson has been named manager, Truck Dept.

Mack Truck Co.—E. K. Christensen has been named assistant director of service division and Robert Hamilton has been appointed service engineering manager.

American Bosch Arma Corp., Arma Div.—Victor N. Canizzaro has been appointed controller.

Harnischfeger Corp.—Donald C. Riblet has been named Birmingham district office manager.

Necrology

Thomas Naubert, 73, former national service manager for Ford Motor Co., died May 14 in Dearborn, Mich.

Bernard J. Langford, 60, assistant traffic director for the Chevrolet Motor Div., General Motors Corp., died May 26 in Detroit.

Newton W. Seidel, 62, director of fleet sales for Chrysler Corp., died May 27 in Detroit.

Raymond A. Dickinson, 70, former General Motors Corp. executive and Detroit auto dealer, died May 26 in Port Huron, Mich.

Ralph A. Brevick, 67, retired superintendent of the General Motors Corp. Gear Div., died May 16 in St. Clair Shores, Mich.

Kenneth O. Cogger, 46, manager of the Aluminum Co. of America plant in Massena, N. Y., died May 14 in Massena.



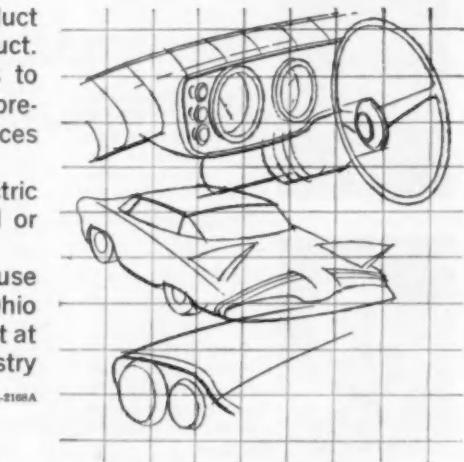
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CANADA: Railway & Power Engr. Corp., Ltd.

EXPORT: Copperweld Steel International Company, 225 Broadway, New York 7, New York

an Editorial

Progress Reported on U.S. Automobile Export Program



PROBABLY VERY FEW American citizens realize that when a vehicle produced in the United States is sold in the United Kingdom, for example, a "purchase tax" is levied at a rate of 50 per cent calculated on approximately 5/6ths of the basic list price. This is unduly burdensome on sales of U. S. passenger cars, as it is applied to a list price which includes a high discriminatory ocean freight charge and the 30 per cent ad valorem duty, also levied on a CIF basis. Probably very few American industrialists also know that as a step toward alleviating these and comparable conditions in other countries throughout the world, instructions have gone out to all United States Ambassadors abroad to give a high priority to the promotion of American exports. Such steps include, among others, negotiation of realistic reductions of prohibitory trade barriers such as excessive purchase taxes.

THERE IS A STRONG FEELING among industry representatives that United States negotiators should be firm in their insistence on obtaining a significant reduction in tariffs, as well, plus removal of other trade barriers to United States exports of vehicles. The countries singled out as striking examples of foreign countries which have made little or no concessions in this regard were the United Kingdom, France and Italy. The American automobile industry feels that foreign automobile manufacturers no longer need the degree of protection from outside competition that they did in the early post-World War II years. These foreign manufacturers are now back on their feet and have technical equipment and manpower to compete successfully at home and abroad.

IT IS THEREFORE ESPECIALLY heartening to the American Industry that progress is being made.

In an exclusive statement to AUTOMOTIVE INDUSTRIES, Philip A. Ray, The Under Secretary of Commerce, said: "I assure you that every effort will be made to eliminate and/or reduce the trade barriers which are impeding the exports of U. S. produced motor vehicles.

"IT IS ALSO FELT that the Eximbank new credit guarantees will be beneficial to the motor vehicle industry in quite a few instances. Particularly is this true in exports to Africa.

"THE INDUSTRY HAS SUPPLIED the Government with excellent material which will be of real value to the negotiators at the coming Gatt conference."

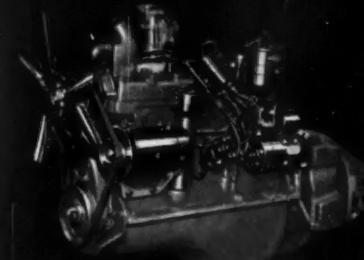
IT IS THEREFORE APPROPRIATE at this time to salute the Under Secretary of Commerce, Hon. Philip A. Ray, for significant achievement which will be appreciated by executives and employees at every level in the more than 6200 plants which manufacture American automotive vehicles or parts, supplies or production equipment. The United States is challenging our foreign industrial leaders to match the policies and attitudes of cooperation which have been typical of American industry. It is expected that some major barriers to U. S. automotive exports will be reduced substantially during the coming year.

THIS PROGRAM IS NON-POLITICAL and has been given the cooperation of Congressional leaders regardless of domestic political party lines. In April, Hon. Lyndon B. Johnson, Majority Leader of the U. S. Senate, asked your editor to supply information which would sum up the progress in this direction. This editorial answers Senator Johnson's request. On behalf of our readers, we wish to thank Senator Johnson for inviting us to prepare this summary of the trends. ■

Kortney W. Barclay

Editor and Publisher

for even the most remote users
of **CHRYSLER POWERED**
industrial equipment



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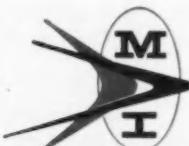
Costly

down time has been virtually eliminated for users of Chrysler-powered equipment by the establishment of new Chrysler engine centers and the expansion of Chrysler's dealer network. There are now 40 strategically located engine centers, 350 dealers in the United States. Almost 400 service outlets.

Each engine center has a large and complete inventory of parts and replacement engines—with special delivery trucks operating throughout the area. Many even operate private airplanes for emergency service and parts delivery. Each engine center also has the service buildings, tools and trained engine specialists to provide service for all types of Chrysler-powered equipment.

This is the fastest, most efficient parts and service set-up in the industry. It is the best insurance you can get against costly down time losses. It is also one of the big reasons why, today, demand for Chrysler Industrial Engines is at an all-time high.

CHRYSLER



MARINE AND INDUSTRIAL ENGINE DIVISION
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Left to right—Richard B. Belford, Tech. Adviser, IFI; Frank Masterson, President, IFI; Prof. D. K. Wright, Case Institute of Technology; Roy P. Trowbridge, Director, General Motors Engineering Standards Section

Engineering Advances in Automotive Fasteners

By

Frank Masterson

President and General Mgr.

INDUSTRIAL FASTENER
INSTITUTE



Frank Masterson

1600 Mechanical Fastening Devices are used in the average U.S.-made production-model passenger vehicle

BETTER fastener engineering and standardization has been the common goal of fastener makers and the automotive industry since 1931. In this period of almost three decades great strides have been taken. Here, then, is the story of IFI and automotive industry cooperation in the fields of fastener research, design, standardization, quality control and inspection. Even greater strides are envisioned for the future as cooperative programs continue to grow.

The average production model car uses 1200 to 1800 mechanical fastening devices (nuts, bolts, screws, washers, etc.). The 1960 Chevrolet has approximately 1400 fasteners, the new Buick about 1700. Every nut, bolt and screw used in the 1960 cars has been carefully designed, engineered, and manufactured to meet rigid automotive fastener standards and specifications.



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President & Gen. Mgr.
National Machine
Products Co.



CARL H. FISCHER
President
Fischer Special
Mfg. Co.



CARL L. HARVEY
Technical Dir., The
Lamson & Sessions Co.



JAMES J. WHITSETT
Secretary, Industrial
Fasteners Institute



FRANK K. KELEMEN
President
K S M Products, Inc.



DUDLEY H. SMITH
Exec. Vice President
Clark Bros. Bolt Co.
Inc.



L. M. ALEXANDER
Mgr., Sales
Bolt Products
Sheffield Div., ARMCO



ROBERT E. BLACK
General Sales Manager
The National Screw
& Mfg. Co.



HARRY O. MCCULLY
Sr. Vice Pres., Russell,
Burdall & Ward Bolt
& Nut Co.



EUGENE W. FULLER
Exec. Vice President
Illinois Tool Works



JAMES G. RAYBURN
Dir. & V. P., The
Lamson & Sessions Co.



JOHN C. JEWETT
Vice President-Sales,
Screw and Bolt Corp.
of America



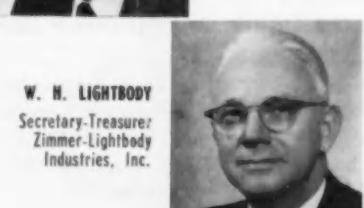
JACK D. CAVAN
Gen. Mgr. of Sales
Republic Steel Corp.
Bolt & Nut Div.



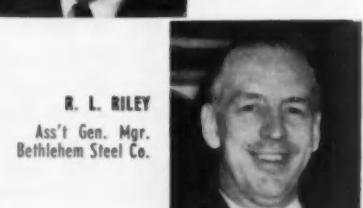
RICHARD R. SWANSON
Exec. Vice President
Grip Nut Co.



JOHN A. MACLEAN, JR.
Pres. MacLean-Fogg
Lock Nut Co.



W. H. LIGHTBODY
Secretary-Treasurer
Zimmer-Lightbody
Industries, Inc.



R. L. RILEY
Ass't Gen. Mgr.
Bethlehem Steel Co.

Thirty years ago, bolts and nuts were looked upon as common blacksmith items. However, times have changed. As the automotive and other American industries made rapid strides forward, it was a challenge to fastener manufacturers to keep pace and match this progress step for step. The Industrial Fasteners Institute and its fastener manufacturing member companies were quick to accept this responsibility, and working together on research, education and technical improvement programs, advanced the knowledge of fastener performance, fastener manufacture and fastener application to their present high degree of engineering acceptance. During this period, the automotive and fastener manufacturing industries cooperated closely to successfully accomplish this common goal of improved fastener engineering.

Over 500,000 Varieties

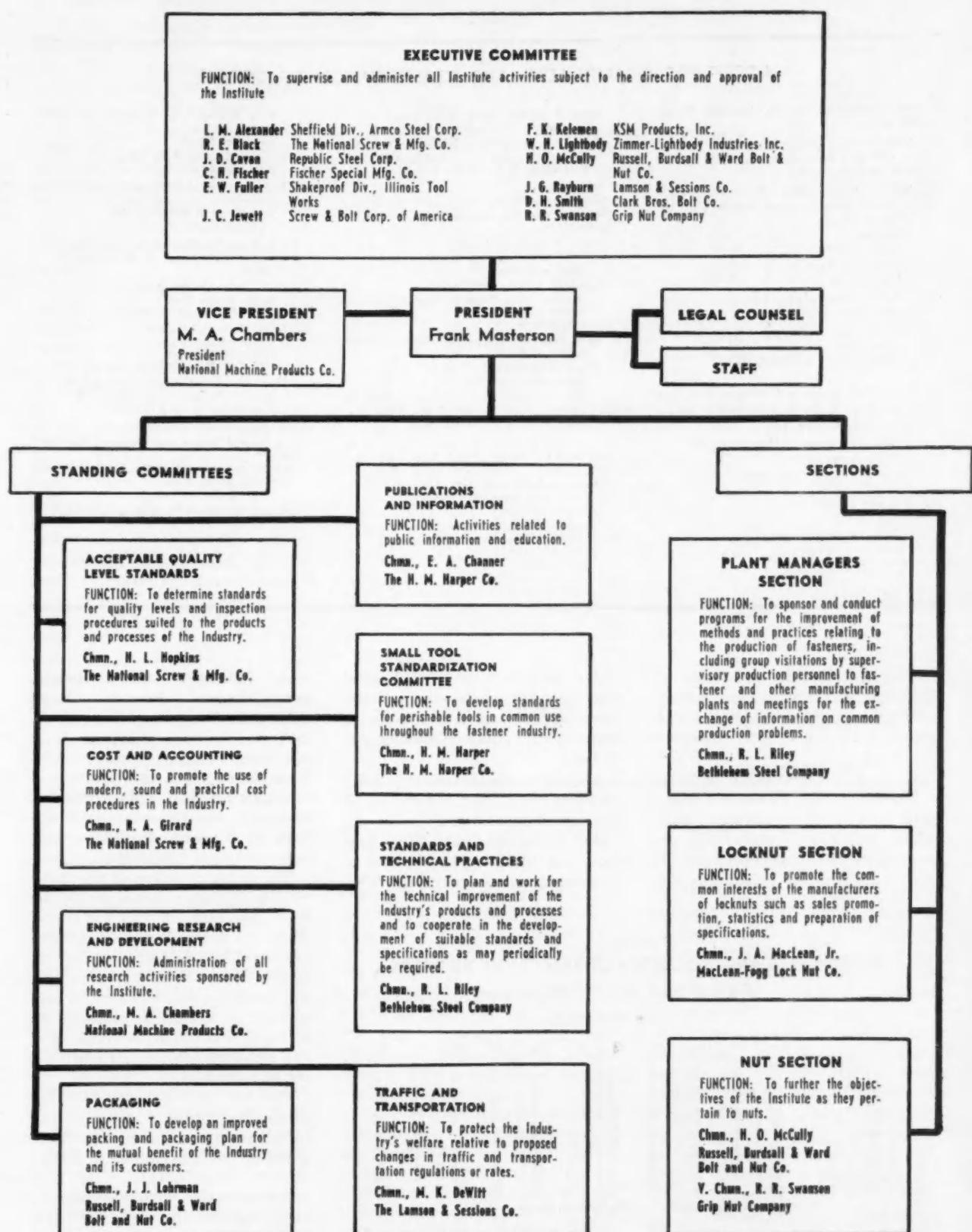
Close to two per cent of all metal, ferrous and non-ferrous, is used in producing the 100 billion fasteners used by American industries each year. There are over 500,000 kinds, types and sizes of readily identifiable standard fasteners. Several times this number of special type fasteners are also available. Fasteners are used in every conceivable application, from missiles to toys, from assembling skyscrapers to furniture. No other component cuts so broadly across American industry.

Automotive is the biggest and most important single customer of the fastener manufacturing industry, absorbing approximately 20 per cent of all fastener production.

Here then is the story of the Industrial Fasteners Institute, and how it cooperates with the auto-

INDUSTRIAL FASTENERS INSTITUTE

ORGANIZATION CHART



RECOMMENDED PRACTICE FOR ACCEPTABLE QUALITY LEVEL FOR BOLTS, NUTS, AND SIMILAR FASTENERS

TABLE I

ACCEPTABLE QUALITY LEVEL AND CLASSIFICATION OF DEFECTS

1. Cold Headed Square and Hexagon Bolts—ASA B18.2	Minor B Defects—10.0% AQL Point where required	Body Diameter or Diameter of Ribbed Neck Height of Head Minor B Defects—10.0% AQL Point where required
Major Defects—2.5% AQL "Go" Ring Gage on Thread Width Across Flats	Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL	Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL
Minor A Defects—4.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length Body Diameter Height of Head Identification	3. Cold Headed Round Head Bolts (Carriage, Step, Elevator, Countersunk Bolts)—B18.9	Major Defects—2.5% AQL "Go" Ring Gage on Threads Width of Square
Minor B Defects—10.0% AQL Point where required	Minor A Defects—4.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length	Minor B Defects—10.0% AQL Points where required
Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL	Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL	Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL
2. Hot Headed Square and Hexagon Bolts and Hot or Cold Headed Lag Bolts—ASA B18.2	Major Defects—4.0% AQL "Go" Ring Gage on Thread Width Across Flats	5. Finished and Semifinished Hexagon Nuts (Cold Punched, Cold Formed, or Milled-From-Bar)—ASA B18.2
Minor A Defects—10.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length Body Diameter Height of Head Identification	Minor A Defects—4.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length	Major Defects—2.5% AQL Width Across Flats "Go" Plug Gage on Threads
Minor B Defects—10.0% AQL Point where required	4. Hot Headed Round Head Bolts (Carriage, Step, Elevator, Countersunk Bolts)—B18.5	Minor Defects—4.0% AQL Radius at Castle Angle of Chamfer "No-Go" Plug Gage on Threads
Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL	Major Defects—4.0% AQL "Go" Ring Gage on Threads Width of Square	Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL
Major Defects—4.0% AQL "Go" Ring Gage on Thread Width Across Flats	Minor A Defects—10.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length	6. Hot Formed Square and Hexagon Nuts—ASA B18.2
Minor A Defects—10.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length Body Diameter Height of Head Identification	Major Defects—4.0% AQL "Go" Ring Gage on Threads Width of Square	Major Defects—4.0% AQL Width Across Flats "Go" Gage on Threads
Minor B Defects—10.0% AQL Point where required	Minor A Defects—10.0% AQL "No-Go" Ring Gage on Thread Thread Length Bolt Length	Minor Defects—10.0% AQL "No-Go" Gage on Threads
Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL		Duds—Incomplete Blank or Foreign Material Sizes—1/4 in. and under—0.40% AQL Sizes—Over 1/4 in.—0.15% AQL

motive industry in the fields of fastener standardization, quality control, product development and research.

IFI HISTORY

The Industrial Fasteners Institute is an unincorporated, non-profit, voluntary membership organization that was organized in 1931. All member companies are

active manufacturers of headed and threaded parts—bolts, nuts, rivets, screws and other like parts made on cold and hot heading machinery.

At its first official meeting of the Institute, July 1931, a total of 17 fastener manufacturers were accepted into membership. Since that time, the Institute has grown to it present membership of fifty-

eight. Officers of the Institute are, Frank Masterson, President; M. A. Chambers, Vice President; R. B. Belford, Technical Adviser; J. J. Whitsett, Secretary-Treasurer. The Vice President of the Institute is normally affiliated with a member company; Mr. Chambers is President of National Machine Products Company, Utica, Mich.

The prime function of the Institute is to foster and promote the best interests of the industrial fasteners industry and its customers in all matters of common interest. Since its very beginnings, the Institute has assisted in and carried on technical research on fastener production methods; and the performance, design and utility of fasteners.

The Institute collects and disseminates industry statistics and information; informs Institute members of governmental action affecting the industry; and promotes a better understanding of fasteners and their efficient utilizations.

TABLE II
SAMPLE SIZE AND ACCEPTANCE-REJECTION NUMBERS
Derived from MIL-STD-105A

Lot Size	Sample Size	Acceptable Quality Level										
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac
0-110	15	0	1	0	1	1	2	1	2	3	4	
111-180	25	0	1	0	1	1	2	2	3	5	6	
181-300	35	0	1	0	1	2	3	3	4	7	8	
301-500	50	0	1	0	1	3	4	4	5	9	10	
501-800	75	0	1	1	2	4	5	6	7	13	14	
801-1,300	110	0	1	1	2	6	7	6	8	18	19	
1,301-3,200	150	1	2	2	3	8	9	11	12	24	25	
3,201-6,000	225	1	2	3	4	11	12	17	18	34	35	
6,001-22,000	300	2	3	4	5	14	15	20	21	44	45	
22,001-110,000	450	3	4	5	6	20	21	28	30	62	63	
110,001-550,000	750	4	5	6	7	31	32	45	48	98	99	
550,001 and Over	1500	7	8	13	14	56	57	81	82	184	185	

Ac—Acceptance number

Re—Rejection number

FASTENER STANDARDIZATION

For no other single industry do standards play such a dominant role. Fastener manufacturers, of sheer necessity, must be, and are, standards minded. Through the years, the fasteners industry has assumed its full share of responsibility in fastener standardization, and with the Institute serving as liaison, has cooperated actively with all the many standardization societies and groups interested in fasteners.

While there is no formal bridge between the automotive industry and the IFI, there is a continual interchange of fastener technology between members of IFI technical groups and key personnel in the automotive industry. These people share their problems and interests on a number of common meeting grounds.

Service on Committees

For example, IFI has strong representation on SAE technical committees concerned with dimensions and physical properties of fasteners. Representatives from IFI and the automotive industry serve together on American Standards Association fastener committees. They meet again in the American Society for Testing Materials, and in American Society of Mechanical Engineers' activities. Representatives from both interests act as consultants to the military and federal government services in the development of government standards.

Automotive Leadership

Also, there is a continual flow of technical information on a personal basis between IFI members and individual automotive technical personnel such as, Roy Trowbridge of General Motors; Jim Boxall and Jack Venema of Ford; Charles Wright at Chrysler; A. S. Jameson at International Harvester; and Russ Holmes at A C Spark Plug, etc.

Automotive industry engineers have often voiced high praise for the capabilities of the Institute's Standards and Technical Practices Committee. Activities of this

TABLE III
GRADES, PROOF LOADS, AND TENSILE STRENGTHS
FOR BOLTS

Grade	Bolt Size Dia., in.	Proof Load, psi	Tensile Strength, min. psi	Material—Heat Treatment
0	All sizes	—	—	No requirements.
1	All sizes	—	55,000	Commercial steel.
2	Up to $\frac{1}{2}$ incl. Over $\frac{1}{2}$ to $\frac{3}{4}$ incl.	55,000 52,000	68,000 64,000	This is intended to be a cold headed product made from low carbon steel; C 0.28 max, P 0.04 max, and S 0.05 max. Lengths over 6 in. may be hot headed from medium carbon steel; C 0.55 max. Deviations from specified chemistry may be made by agreement between producer and consumer.
	Over $\frac{3}{4}$ to $1\frac{1}{2}$ incl.	28,000	55,000	Commercial steel.
3	Up to $\frac{1}{2}$ incl. Over $\frac{1}{2}$ to $\frac{3}{4}$ incl.	85,000 80,000	110,000 100,000	Produced by the cold heading process, up to and including 6 in. in length from medium carbon steel; C 0.28 to 0.55, P 0.04 max, and S 0.05 max.
5	Up to $\frac{3}{4}$ incl. Over $\frac{3}{4}$ to 1 incl. Over 1 to $1\frac{1}{2}$ incl.	85,000 78,000 74,000	120,000 115,000 105,000	Medium carbon steel; C 0.28 to 0.55, P 0.04 max, and S 0.05 max. Quenched and tempered at a min. temperature of 800 F.
6	Up to $\frac{5}{8}$ incl. Over $\frac{5}{8}$ to $\frac{3}{4}$ incl.	110,000 105,000	140,000 133,000	Medium carbon steel; C 0.28 to 0.55, P 0.04 max, and S 0.05 max. Oil quenched, tempered at a min. temperature of 800 F.
7	Up to $1\frac{1}{2}$ incl.	105,000	133,000	Medium carbon fine grain alloy steel*: C 0.28 to 0.55, P 0.04 max, and S 0.05 max, providing sufficient hardenability to have a minimum oil quenched hardness of 47 RC at the center of the threaded section one diameter from the end of the bolt. Oil quenched and tempered at a min. temperature of 800 F. Re-threaded after heat treatment.
8	Up to $1\frac{1}{2}$ incl.	120,000	150,000	Medium carbon fine grain alloy steel*: C 0.28 to 0.55, P 0.04 max, and S 0.05 max, providing sufficient hardenability to have a minimum oil quenched hardness of 47 RC at the center of the threaded section one diameter from the end of the bolt. Oil quenched and tempered at a min. temperature of 800 F.

* Carbon steel may be used by agreement between producer and consumer. NOTE: Carbon range is for check analysis of product.

Committee cover the full gamut of mechanical fastening technical problems. For examples, a few years ago, working closely with the automotive industry, the Committee assisted development of a simplified material grading system for fasteners. This system, including only eight grades (Table III), replaced a heterogeneous jumble of about 20 overlapping grades, and permitted elimination of considerable waste, extra inventory, identification problems, etc. This Committee prepared, and keeps current, the Institute's handbook, BOLT, NUT AND RIVET STANDARDS, which

for the past twenty years has been accepted as the authoritative source for fastener standards, both within the industry and by all the consuming interests it serves. Recently the Committee initiated an investigation to gain new knowledge on the effect to different types of fasteners of different materials and platings when exposed in a variety of corrosive atmospheres. Such data should be of interest to automotive engineers in assisting them to design better cars. The objective approach characterizing the Institute's Standards and Technical Practices Committee, has earned



CASE INSTITUTE OF TECHNOLOGY TEAM

Above: Left to right: Prof. D. K. Wright, Jr., Professor of Machine Design; Prof. H. R. Nara, head of Civil Engineering and Engineering Mechanics Department; and W. H. Tuppeny, Jr., Graduate Assistant, comprise the team heading up Project 550—a three-year basic engineering research project on fasteners and their technical behavior.

for it a high respect and rare prestige seldom enjoyed by an industry committee.

International Scope

In recent years, the need for the United States taking a more active role in international standardization has become increasingly apparent. Both the automotive and fastener manufacturing industries have recognized the importance of

this work, and have accepted responsibility in this area. Roy Trowbridge served as leader of a nine-man delegation to an ISO screw thread committee meeting at Harrogate, England in June 1958. Dick Belford also attended this meeting, and in October 1959 served as leader of the American group to an ISO meeting concerned with fastener standardization at Milan, Italy.

ACCEPTABLE QUALITY LEVEL

As with all mass produced items, it is difficult to produce perfect fasteners consistently. While a goal of perfection is desirable, and one that most manufacturers constantly strive for, there are reasons inherent in the production process which make it almost impossible to attain or maintain. For

instance, slight imperfections in the raw material are common, dies and tools wear during their useful life, setup of machines tend to vary slightly.

There are a number of things the fastener manufacturer might do to assure higher levels of quality—rigidly inspect and metallur-

FASTENERS ARE 25% OF THE ITEMS IN ONE VEHICLE

Frank Masterson says:

"Not in dollars and not in tons, but in purchase order items, fasteners represent about 25% of the item numbers that go into a vehicle. This places fasteners near the top of the list in money spent for design, engineering, quality control, inspection, inventory, production line quality and availability and the ultimate safety and comfort of the driver of the car."

gically test all incoming materials, buy improved machines and other manufacturing equipment as they become commercially available, greatly increase in-process and final inspection of fasteners. But, all of these approaches to improve fastener quality cost money. Quality is not a cost-free commodity.

"Quality Conscious" Automotive Concepts

The automotive industry is quality conscious. Because passenger safety is dependent on properly assembled cars, it is imperative that automotive companies use fasteners of the highest quality demanded by the application. Several years ago the Acceptable Quality Level Standards Committee of the Industrial Fasteners Institute, working closely with technical representatives from the automotive industry, established an AQL recommended practice for six basic fastener product groups. These levels and their application are listed in Tables I and II.

AQL control is a statistical system of quality evaluation based on inspection by attributes of a sample selected at random from the full product lot submitted at one time. The sample size, acceptance and rejection numbers for defective parts are predetermined mathematical functions of lot size,

Roy P. Trowbridge Commended

and the acceptable quality level specified. Defects, major and minor, are determined by mutual agreement between producer and user.

Mutual Interests Shown

Setting down on paper these recommended practices of AQL for bolts, nuts and similar fasteners was considered a tremendous step forward. The very fact that the automotive industry and the IFI worked together on this project demonstrated a serious realization by both interests of the importance of attaining quality, and assuring its continuation in mass production operation. These levels have worked well, and only in the last few months has there been any activity for changing them. Now, because of intense pressures to produce safer and more reliable products, coupled with use of more automated assembling equipment, a need to review present quality levels appears desirable. As quality levels are improved, cost of manufactured components usually increases. However, this added expense will be saved many times over because of uninterrupted performance on the assembly line, and greater dependability of the assembled vehicle. The Institute's AQL Committee will soon meet to discuss current problems in the automotive industry.

LOCKNUTS

The Institute's Locknut Section, made up of those member companies manufacturing one or more types of locknut, is interested in furthering the understanding and use of locknuts through technical projects, dissemination of statistics, and promotional activities. Locknuts have wide usage in vehicles, and are specified where the special safety requirements of the applications can only be satisfied by positive locking of the mating fasteners.

In 1955, the Section first published its specifications for prevailing-torque type locknuts. During the development of this important specification, automotive engineers were contacted, and their advice,

Since 1958, standards engineers have commended the outstanding work of Roy P. Trowbridge, director of General Motors' Engineering Standards Section, for his outstanding leadership of the United States Delegation on screw threads at the meetings of the International Organization for Standardization.

Mr. Trowbridge received his Bachelor's degree in mechanical engineering from Stanford University in 1940. His career has been especially identified with development work on precision reference specimens now identified as American Standard. In addition to his ASA activities, Mr. Trowbridge is a member of parallel SAE technical standards committees. He is a member of the SAE, ASME and the Engineering Society of Detroit.

ideas and suggestions invited.

Most of their recommendations were extremely valuable, and were incorporated into the final specification. These preliminary discussions paid rich dividends, because this specification was subsequently accepted and generally subscribed to throughout the automotive industry. Recently, Roy Trowbridge stated, "It is true that new types of locknuts, and the new specifications for locknuts, are having an immediate effect on improving reliability. The new locknut specification is doing a good job."

Like all standards, this locknut specification is regularly reviewed and revised to reflect improvements in the industry's manufacturing techniques, and also to recognize changing service requirements. Just a couple of months ago, the specification was expanded at the request of the automotive industry to include the smaller sized locknuts, No.'s 4, 6, 8, 10 and 12.

Another automotive industry problem centers around relating

tightening torque of locknuts to development of tension in the bolt or stud. This question has an added complication because of the prevailing-torque characteristic featured in the locking principle of so many locknut designs. However, working together, the Institute and the automotive industry expect that a practical answer can be determined.

PUBLICATIONS

In 1958, the Institute published DESIGNING PARTS FOR COLD AND HOT HEADING to encourage designers to study the attractive potentials of headed parts. Many parts, now manufactured by other methods, are ideally suited for conversion to heading, and enjoyment of the accompanying savings and other advantages which are offered. The automotive industry has always been quick to appreciate the economies of headed parts, and over the years, has worked closer with the fasteners industry in experimenting on new special headed developments than other consuming interests.

IFI ENGINEERING RESEARCH AND DEVELOPMENT COMMITTEE

Basic engineering research and development work on fasteners is a major program of the Industrial Fasteners Institute. Much of this work has been done in individual fastener manufacturer's laboratories. A number of research projects, however, for the study of fastener characteristics and behavior have been farmed out to leading engineering universities.

In September, 1956, the IFI Standards and Technical Practices Committee reviewed a proposed new specification for nuts.

This was sponsored by the automotive industry in an effort to get a clearcut set of specifications detailing physical properties of nuts.

The proposed specifications pre-
(Turn to page 101, please)

Armored Vehicles in America's Future



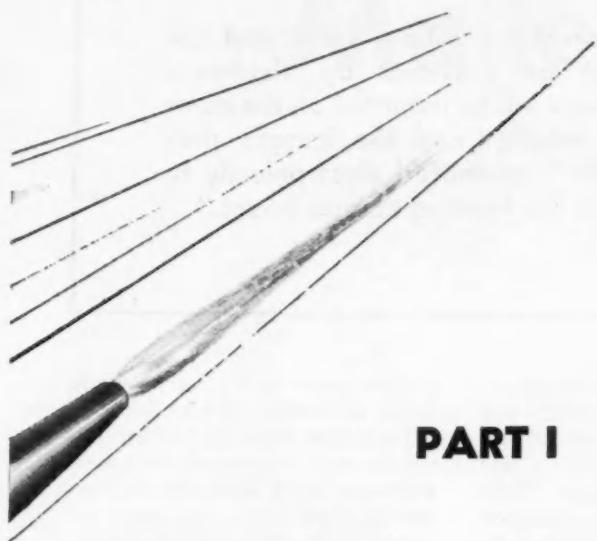
THE advent of nuclear weapons has increased the need for Armor on future battlefields. General Bruce C. Clarke, Commanding General, U. S. Continental Army Command, has said:

"In discussing Armor, we must consider it as a member of the combined arms team. I am convinced that Armor will play a vital role on the future battlefield—as a member of that team. If I ever doubted the potential of Armor, such doubts were erased when, as Commander of Seventh Army, I assessed the capabilities of the 70,000 tanks just across the Iron Curtain."

CURRENT MEDIUM GUN TANKS

Progress in tank design during the first nuclear decade amounted to little more than refinement of basic designs evolved toward the end of World War II. The basic type of tank remains the medium in the 40 ton class, which in essence originated with the German "Panther" medium tanks of 1942 and consists of the following five basic systems:

- Ferrous Armor
- Full-Track Suspension
- Reciprocating Engine
- Three to four-Inch High Pressure Gun



PART I

By

RAYMOND J. ASTOR
Major, Ordnance Corps.
US Army

PRESENTLY ATTENDING
US Army
Command & General Staff College
Fort Leavenworth, Kansas

FORMERLY
Executive Officer
Research & Engineering Directorate
US Army
Ordnance Tank-Automotive Command
Detroit, Mich.

—Kinetic Energy Ammunition
Four-Man Crew

The use of these basic systems means that the tanks of the various nations are roughly comparable, with no clearly decisive superior features having been established for any contestant. Yet these five basic systems are closely related, since each contributes to the bulk that must be enclosed by armor and propelled across the terrain. A technological breakthrough in any single system would generate a reaction in the others that could result in a really decisive advantage in vehicle design.

CURRENT HEAVY GUN TANKS

In support of the medium, there continues the heavy gun tank which was introduced during World War II by the German "Tiger" and the Soviet "Stalin" and which has been perpetuated since by improved versions of the latter and the British "Conqueror" and United States M103 Tanks armed with 120mm Guns.

CURRENT LIGHTWEIGHT TANKS

Lighter and more mobile tanks have been advocated periodically as the answer to the pressing need for greater over-all mobility, but with little practical effect. Even in the United States where such great progress has been made since World War II in airborne operations, no battle-worthy, air-transportable tank was evolved until comparatively recently. The one notable exception to the general trend, the French AMX light-weight tank, indicates what can be accomplished by departing from the rut of established practices and utilizing the latest technological developments to solve the problem.

CURRENT ARMORED PERSONNEL CARRIERS

One sector of armored equipment where genuine progress has been made in several countries since 1945 is that of armored personnel carriers. The absence of cross-country carriers has been the stumbling block of earlier armored formations and the overdue introduction of this type of vehicle finally made it possible to combine riflemen with tanks and other self-propelled heavy weapons effectively. In essence, the development of armored carriers has made it possible to create effective mixed armored units and thus fulfill one of the principal requirements of the future. The introduction of armored personnel carriers also increased the over-all cross-country mobility of armored units, but their development barely has touched the range of possibilities and the many urgent needs.

(Continued)

FUTURE ARMOR REQUIREMENTS

General Bruce C. Clarke knows exactly the type of tank the United States requires and I quote:

"We know exactly what we want. Take the single item of the tank: our requirements are simple. We want a fast, highly mobile, fully armored, light-weight vehicle. It must be able to swim, cross any terrain, and climb 30 degree hills. It must be air-transportable. It must have a simple but powerful engine, requiring little or no maintenance. The operating range should be several hundred miles. We would also like it to be invisible."

This requirement could be approached and perhaps fulfilled completely if the United States were willing to assign the necessary scientific resources of the nation to the problem. Let us examine the problem and determine how this could be achieved.

THE FUTURE FIELD ARMY

In any future conflict, the field army will be subjected to very heavy blasts from both atomic and non-atomic types of ammunition. In addition to blast effects, the atomic munitions will, of course, have accompanying radiation characteristics; and the non-atomic type ammunitions can be expected to spread high densities of fragmented munitions on the battlefield. All of these effects will be extremely lethal to any exposed troops. Various types of gases and other airborne fatal agents will be encountered. While dug-in positions will provide protection from a number of these weapon systems, such positions will immobilize the troops in an era when battlefield mobility will be the key to success. On the other hand, mobility and protection by themselves will not be sufficient for battlefield exploitation. Heavily armored enemy vehicles can be expected to be encountered and only with superior weapon systems can the enemy be defeated.

ARMOR PROTECTION

The armor of the future, while looking a great deal different from the vehicles we recognize today,

An Electronic Marvel, Next

"In the armor of the future, vision and fire control must be provided by electronic means. Viewers will be mounted on the outer skin of the vehicles and the images they pick up will be transmitted electronically to screens within the fighting compartment."

must be able to carry the attack rapidly into enemy territory and must be able to operate on an atomic battlefield, exploiting our own use of nuclear weapons. These vehicles must provide protection of their crew against radiation effects which can be expected to be prevalent on the battlefield. Armor protection that is capable of stopping or reducing radiation to a tolerable level must be developed. Furthermore, provisions must be made in these vehicles to seal them completely and provide them with their own purified atmosphere to assure a livable medium for the operating personnel. In order to perform a combat mission, these mobile encapsulated crews will, of course, have to have a number of

devices and weapons not presently found on combat vehicles.

Battlefield mobility which envisions rapid movements over long distances, quick assembly and dispersal, presents an incongruity in requirements. The armor protection required on these vehicles of the future can be expected to be quite heavy and bulky. On the other hand, weight becomes a critical item in the anticipated fluid situation. First, when the vehicle is operating under its own power, weight can be related directly to fuel consumption. Secondly, as the vehicles are being moved by other transport means, we encounter definite limitations on vehicular-weight, especially if air transport

(Turn to page 103, please)



A prototype model of a new Army land mine sweeper electronically controlled. The detector boom sweeps either side or ahead of the vehicle truck. Detection of a mine electronically sets vehicle brakes instantly.

Malleable Iron makes big advances

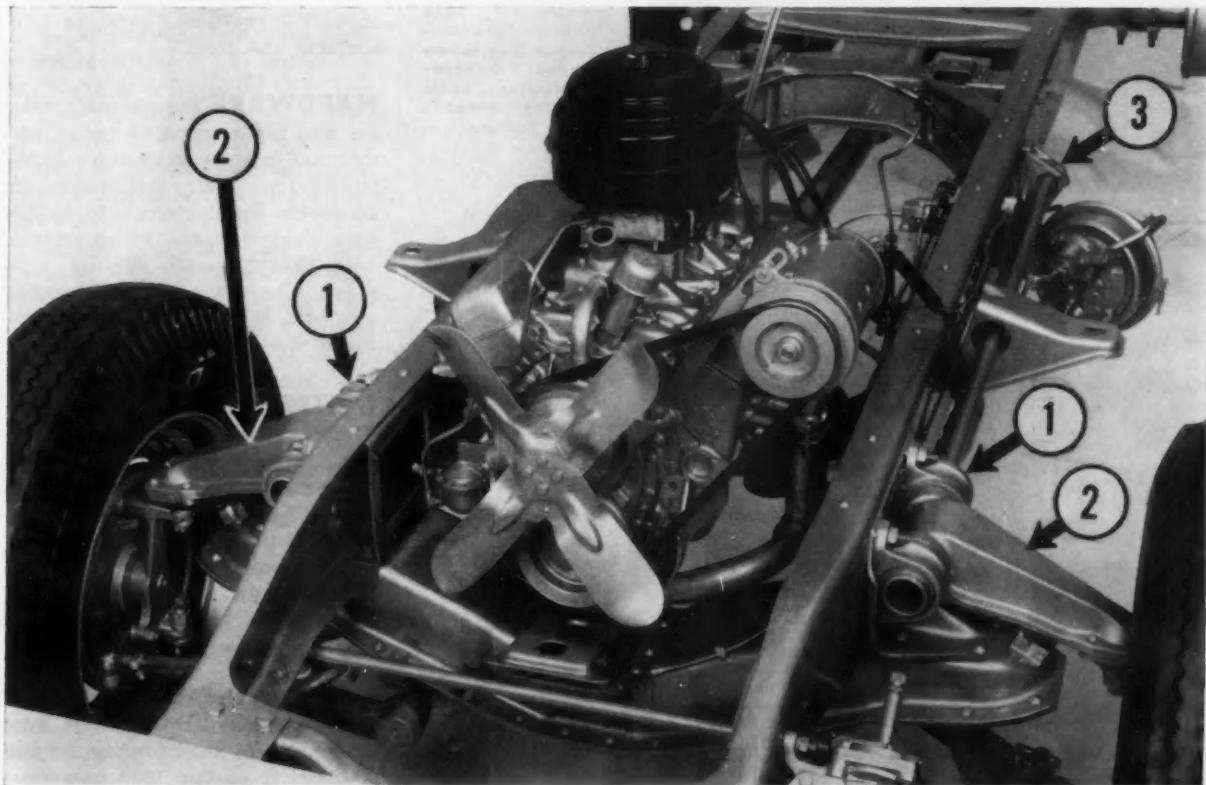
**Automotive Consumption
Estimated at 590,000 Tons**

By
Norman M. Lloyd
MARKETS EDITOR

New malleable applications on 1960 Chevrolet heavy-duty trucks—(1) steering knuckle upper control arm shaft bracket; (2) steering knuckle upper control arm; (3) torsion bar anchor bracket.

THE producers of malleable iron castings are getting a boosted takeoff for 1960. In the face of increasing numbers of competing materials, new automotive applications for malleable parts are providing a firm base for increased business activity.

THE COMPACTS An average of 80 lb of malleable—proportionately more than is in their big-car cousins—is used in Detroit's compacts. The differential carrier, for many years made of malleable, is now utilized to form the backbone of the axle in many of these models. In the Ford Falcon, the unit consists of a malleable carrier



housing into which tubular steel extensions are pressed. Using this casting as a backbone to the axle as well as a housing for the drive system eliminates the conventional banjo case, previously an assembly of welded stampings.

The carrier housing, tooled on standard setups at the Ford Sterling Chassis Parts Plant, is a one-piece casting with a rear opening to facilitate gear assembly. This design has made possible a carrier housing assembly, fully aligned and adjusted, which is sound-tested before the rear axle is finally built up.

Upon acceptance in the sound booth, the carrier assembly is moved to a horizontal press where the tubular ends are pressed into large drilled holes with an interference fit. The ends are then secured by welding.

Milling, rough boring and cham-

fering, finish boring, drilling and tapping are completed in five machine stations. The differential bearing bores are machined with a spindle which bores both ends in a single pass, assuring alignment and concentricity. The pinion bearing bores are machined from one end, providing concentricity and squareness.

Influenced by its excellent bearing properties, machinability and cost advantages, engineers selected pearlitic malleable iron for several of the moving parts of the Corvair "transaxle." These included the planet carrier, reverse ring gear, output and stator shafts, torque turbine hub and shift selector parts. The differential case and cover as well as the rear axle universal joint yokes are also pearlitic malleable castings.

Chrysler has designed 111 lbs of malleable castings into the

Valiant. This amount represents an increase of 21 lbs over the average used in standard size cars for 1959.

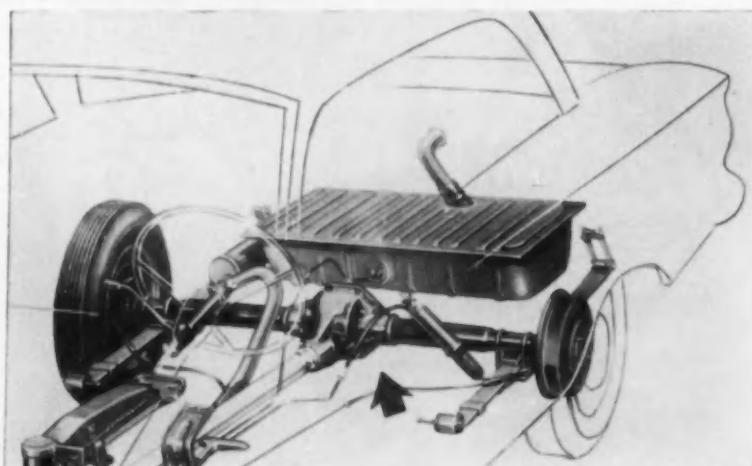
TRUCKS One of the series of new truck engines at GM this year contains a malleable crankshaft. This represents the second major change to malleable cranks in recent years.

"The decision by Truck & Coach to use our crankshafts was preceded by vigorous and extensive testing," reported the supplier of the part. "It confirms our conviction that crankshafts cast of special pearlitic malleable iron are equal to the task in every respect, while offering important savings over forged counterparts."

New front suspension systems on GM, GMC and Chevrolet trucks utilize malleable castings. With torsion bars replacing the conventional leaf springs, medium and heavy truck models feature rigid pearlitic malleable iron control arms. The arm is engineered to retain front members in position and alignment at all times. It also minimizes sway and roll on curves, since it extends the effective spring center to its outboard point, almost above the position where the tire contacts the road.



Tubular steel extension cold-pressed into malleable iron differential carrier eliminates banjo housing on Ford's Falcon.



HARDWARE The malleable makers also see a trend to use of the material in some automotive hardware. Last year, GM made an across-the-board change to malleable door hinges, which meant 1500 tons a month for its suppliers. The castings offered greater strength at less weight than the rolled steel parts they replaced.

MATERIAL ADVANTAGES

The conversions to malleable are due primarily to (1) its machinability and (2) the higher strengths now available.

Introduction of the pearlitic grades, some of which rate as high as 125,000 psi, and the development of precision testing techniques for measuring the mechanical properties of castings have improved the strength picture for malleable. The choice of pearlitic malleable over an SAE 1045 steel forging for the crankshaft of one 1959 passenger

car was directly influenced by these factors.

According to the manufacturer, the use of malleable had these advantages:

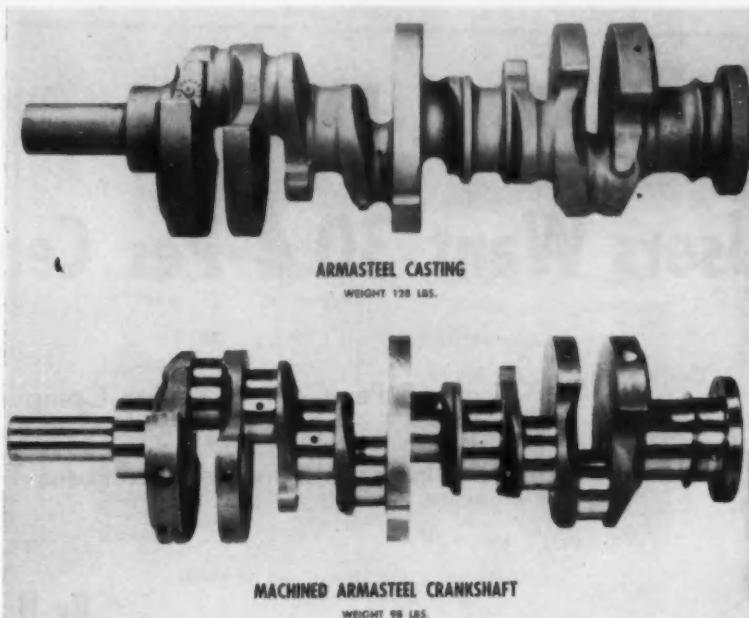
- an increase of tool life of 100 per cent
- reduction of machining cycles 33 per cent to 50 per cent
- substantial reduction in capital investment for machine tools
- the use of 6 types of carbide tools instead of the usual 25
- less stock removal

The absence of residual stress and improved bearing life during use were also listed as advantages, but the cost savings during machining sold the manufacturer on the switch.

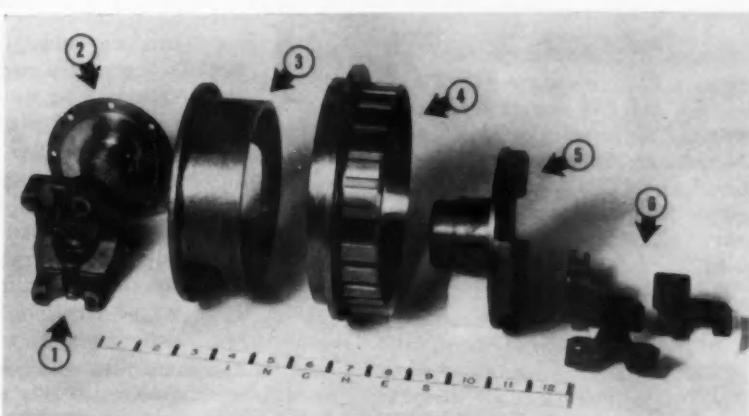
THE MARKET Malleable's continued use and acceptance by the automotive industry has led to an active expansion by suppliers. If Detroit's estimate of 6.7 million 1960 models is accurate, it will mean the sale of 590,000 tons of malleable castings— $5\frac{1}{2}$ million lb of the material every working day. In response to this push, the foundries specializing in automotive hardware have increased their productive capacity by approximately 24 per cent. They are currently geared to produce an additional 115,000 tons over last year's 490,000 tons.

National Malleable and Steel Castings (40,000 tons annually) has reopened its Indianapolis foundry. A merger of Albion Malleable Iron Co. and Muncie Malleable Foundry will bring the latter's 20,000 tons a year potential into the automotive supply market. Other plants are expanding their existing facilities.

Although the applications for malleable in automotive production are on the increase—to about 75 different parts and components—this has not always been reflected in tonnage shipped. Stronger material normally means that less is required to do the job. But malleable producers have been able to boost tonnages by winning new business. ■

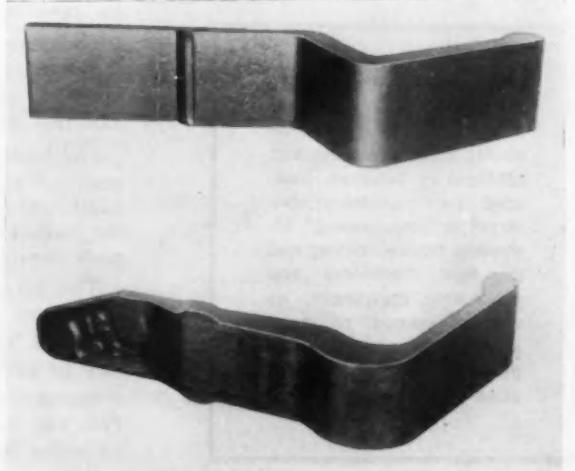


Pearlitic malleable crankshaft used in GMC's series 305 truck engine.



Malleable gear components in the Corvair transaxle include (1) universal joint yokes, (2) torque turbine hub, (3) planet carrier, (4) reverse ring gear, (5) output shaft and (6) selector forks.

Rolled steel strap hinge (top) replaced by ferritic malleable (below)



INDUSTRIAL ENGINES...

Users Want 30.4 Per Cent More in '60

Over 63 Per Cent of Buying Companies Polled By
AUTOMOTIVE INDUSTRIES
Indicate Increased Purchases This Year

By Norman M. Lloyd

MARKETS EDITOR

If you produce industrial engines, or sell them, or supply their manufacturers, the results of a recent poll made by AUTOMOTIVE INDUSTRIES will be of definite interest to you. It points to a rapid expansion of the market with a sharp rise in purchases for 1960.

One hundred and eighty companies that buy and use industrial engines were questioned about their current and planned requirements with specific reference to the number purchased, the type, the piston displacement and the brake horsepower rating. Plants employing 50 or more production workers were polled in Standard Industrial Classification groups that included both known buyers of this product class and those whose position in the market was either marginal or unknown.

Of the companies surveyed, 63.9 per cent have indicated that they will buy more engines this year than last—almost 300,000 more. This represents an increase of 30.4 per cent over 1959.

In 1959, total reported engine purchases of these plants was 1,047,926. Of these, 1,032,437 were gasoline and 15,489 were Diesel. Planned purchases for 1960 total 1,346,864—1,326,512 gasoline and 20,352 Diesel. This points up an increase of approximately 28 per cent for gasoline engines and 31 per cent for Diesel over last year.

The reasons behind this unprecedented demand are the resurgence of the construction industry, the continuing trend toward farm mechanization, and a growing list of applications for Diesel and small gasoline engines.

The booming power lawn mower industry, which consumed approximately 4 million small engines in 1959, is expected to increase by an additional half-million units during the 1960 selling year. The size of the market seems to be limited only by the number of homes with grass plots requiring occasional cutting.

The leisure market, coupled with a population race to the suburbs, is further stretching the sales potential for small gasoline engines. Powered "chore" tools such as tillers, trimmers, saws, plows, etc., can now be purchased or rented from almost any hardware store.

Another example of product fulfillment is the application of existing two- and four-stroke engines to a new line of consumer products known as hobby "go-carts."

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Engine Buying
Companies
cooperated . . .

The variety of products manufactured by the companies polled by AI included special purpose and off-highway vehicles, powered farm machinery, construction equipment, industrial trucks, mining and oil field machinery and processing equipment, as well as pumps, compressors, and other product applications using small gasoline engines.

At present, Diesel engine manufacturers are expanding into new vehicular markets. More attention is being devoted to the low end of the horsepower range.

Diesel engines are being evaluated on lighter trucks for low-load, short-haul service. More farm tractors are being equipped with Diesel power plants — approximately 24 per cent of total production in 1958.

One of the strongest potential markets for Diesels is the taxicab. Fleet owners are already operating Diesel cabs in most major American cities, including Detroit, San Francisco, Los Angeles, New York, Atlanta, Indianapolis, Chicago, South Bend and Kansas City. Many of these units are still under study, but at least half are reported to be in "regular" service. As more operating unknowns are nailed down, the growth of the Diesel fleet is expected to reach over 1000 units within the next year and a half.

Increasing demands upon municipal electric power is partly being met with the development of more efficient, more compact, and more powerful Diesel engines.

The introduction of supercharged Diesels will open additional markets that were previously closed due to unsatisfactory power-to-weight ratios.

The Federal Highway Program, which will require some \$20 billion in roadbuilding equipment over the next 13 years, has generated additional benefits and markets. Urban areas developed along new Federal and state highways are creating demands for additional rapid transit facilities. This, in turn, completes the circle—a growing need for more basic construction such as housing, sewers, roads, utilities, water source facilities, etc. To handle this work load, many thousands of vehicles will serve out their useful life and be scrapped, to be replaced by others.

Today, each farm worker provides food and fiber for approximately 22 people. The increasing demand for farm products and a continuing rise in farm wages has directly influenced the trend toward mechanization which has in-

PISTON DISPLACEMENT OF ENGINES PURCHASED (Cubic Inches)

1959		1960	
Displacement Range	Reporting Companies	Displacement Range	Reporting Companies
1-134 cu in.	82	1-134 cu in.	78
135-200 "	43	135-200 "	40
201-399 "	63	201-399 "	59
400-534 "	37	400-534 "	37
535-700 "	21	535-700 "	18
Over 700 "	22	Over 700 "	21
No Answer	15	No Answer	18

(Does not add to totals due to multiple answers)

creased more than 80 per cent over 1950 levels. Farmers are spending \$6 billion annually to buy and maintain the vehicles and machinery. Mass production agriculture is relying heavily on equipment to not only bulk handle products at reduced cost, but to save time and money lost in such chores as feeding, watering, loading, etc.

The expanding applications for internal combustion engines has raised production levels to a total of 5.9 million (excluding outboard, automotive and aircraft) in 1958,

the last year for which complete figures are available. This is an increase of almost 832,000 engines over 1957. A total of 5.7 million gasoline engines were produced in 1958, an increase of 17 per cent over the corresponding '57 figure of 4.9 million. Diesel and semi-Diesel engines totalled 132,000 units in 1958.

Increased consumer and industrial demands will raise production levels to an estimated eight million units in 1965, 9.5 million in 1970 and 11 million in 1975. ■

BRAKE HORSEPOWER OF ENGINES PURCHASED

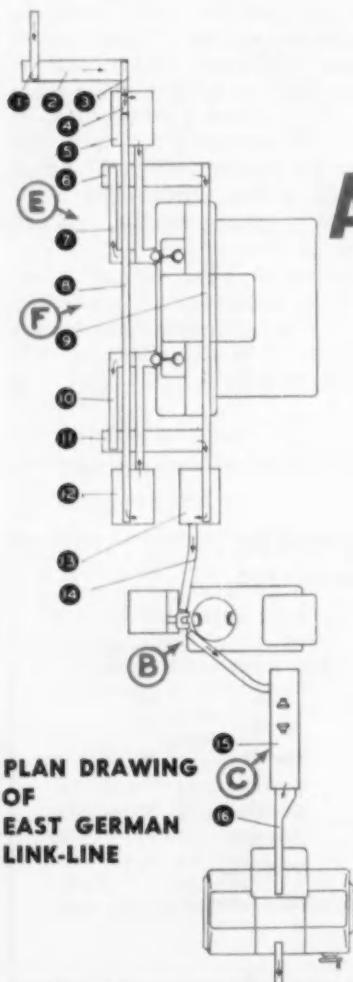
1959		1960	
BHP Range	Reporting Companies	BHP Range	Reporting Companies
1-49	89	1-49	90
50-99	47	50-99	47
100-149	37	100-149	38
150-199	24	150-199	21
200-300	32	200-300	30
Over 300	15	Over 300	13
No Answer	7	No Answer	7

(Does not add to totals due to multiple answers)



ILLUSTRATION A—GENERAL VIEW—ALSO DIAGRAMMED BELOW

General view from the end of the link-line, which terminates in an automatic deburrer. Gears from the inclined washer are fed in by a gravity track ending in a short vertical chute that drops them singly into the pre-load position behind the opposed work spindle. When these centers retract to release a finished gear the next workpiece rolls into place.



**PLAN DRAWING
OF
EAST GERMAN
LINK-LINE**

East German Gear Line Automates Standard Machines

AN automatic link-line for hobbing, deburring and shaving single spur gears for the transmission of the small Trabant car is now being installed at the Zwickau factory in East Germany.

It combines standard machines for a low-cost approach to full automation, and features standardized gravity chutes, storage magazines and handling equipment, and a flexible layout that simplifies retooling for gears of four different sizes. Average output is 40 pieces per hour for a cycle time of 90 seconds.

By David Scott
Special European Correspondent
for AUTOMOTIVE INDUSTRIES

First machine is a duplex hobber, and blanks on the incoming gravity chute are picked off singly by a chain elevator which carries them to the top of a zig-zag magazine, holding 30 pieces, that feeds the left-hand hobber. A switch blade at the entrance to this magazine directs alternate blanks to an inclined chute leading to a second magazine supplying the right-hand

- 1—Incoming gravity track
- 2—Chain elevator
- 3—Short length of gravity track
- 4—Switch blade
- 5—Zig-zag magazine feeding left-hand hobber
- 6—Chain elevator
- 7—Exit track from left-hand hobber
- 8—Track to right-hand magazine

- 9—Track to deburring magazine
- 10—Exit track from right-hand hobber
- 11—Chain elevator
- 12—Magazine feeding right-hand hobber
- 13—Magazine feeding deburrer
- 14—Track to deburrer-load/unloader
- 15—Washing machine
- 16—Track to shaver

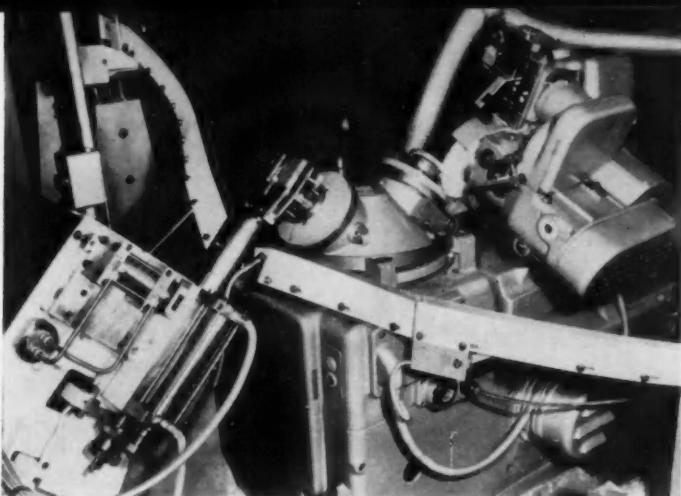


ILLUSTRATION B

Twin-spindle deburrer is loaded by a pneumatically-operated hand whose complex cycle of thrust, vertical and rotary movements is cycled by electro-pneumatic limit switches. Gears are turned over between grindings on the helically-profiled wheel to machine both sides. Semi-circular track flanking the indexing table rotates the outgoing work spindle assembly so that the location pin engaging the gear teeth is directly above the spindle to clear the U-shaped hand.

ILLUSTRATION C

Inclined washing machine is divided into compartments for two hot chemical washes, rinsing and air drying. The chain elevator carrying gears is periodically indexed upward by a pre-set timer that controls the pneumatic rack and pinion mechanism geared to the drive chain through a free wheel.

unit. Hobbing operations are identical, but are duplicated because individual cycle times are about 3 minutes.

As each blank is released from one of the magazines by a solenoid-operated escapement mechanism it rolls down the loading chute that terminates in a hydraulic tilting arm which swings it from vertical to horizontal. In this position the blank now lies between the open jaws of one end of the horizontal swiveling loader, while the twin jaws at the other end are flanking the cut gear in the hobber.

Duplex hobber is fed by individual storage magazines (extreme right and left) with incoming gear blanks alternated between the two by a switch blade at the top of the left-hand unit. Cut gears from the exit chutes are carried by individual chain elevators to the second overhead gravity track leading to the deburring machine.

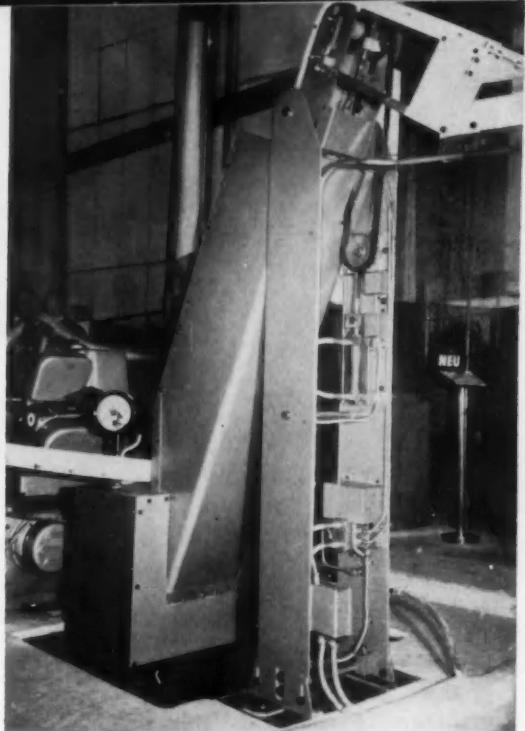


ILLUSTRATION D

Gear gripped between opposed work spindles is shaved by a wheel that feeds up from below and traverses across the teeth between reversals. The two final passes are without infeed.

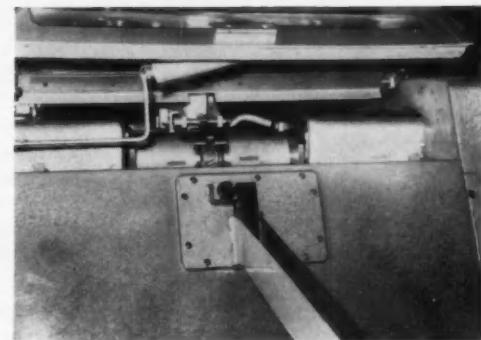


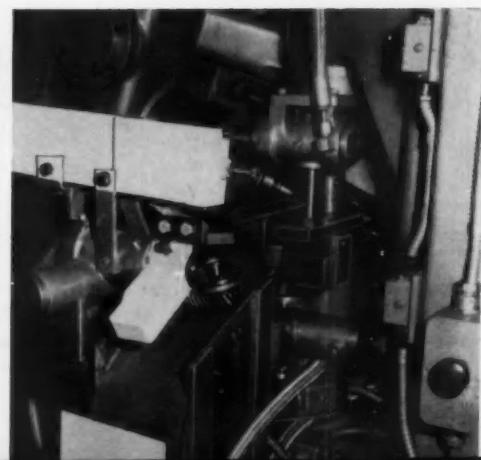
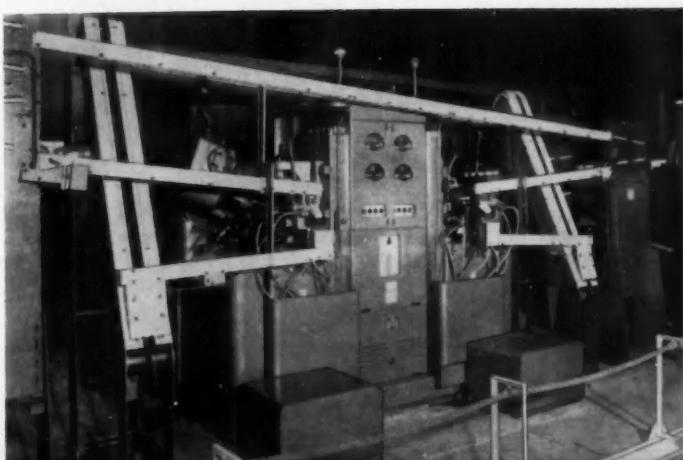
ILLUSTRATION E

Meanwhile, the hobbing slide retracts, the work slide returns vertically to the start position, and the vertical locating spindle and

clamping face withdraw from the gear bore. Now the parallel arms of the swiveling load/unloader are
(Turn to page 114, please)

ILLUSTRATION F

Swiveling loader serving the standard hobber consists of two spring-expanded parallel arms that are hydraulically clamped together to grip incoming and outgoing work with opposed jaws. Photo shows a cut gear being dropped onto the exit chute while the blank is released on the work spindle beneath the refracted location spindle and clamping face.



New Developments at Thompson-Ramo-Wooldridge

THE Valve Division of Thompson-Ramo-Wooldridge is currently expanding its activity in research and development aimed at new components and accessories for internal combustion engines. Two items of exceptional merit have been developed recently. One of these is a gasoline engine turbocharger of simple design, said to be a comparatively low cost installation; the other is a low cost controllable speed fan for use with air-conditioned cars.

The turbocharger, shown here in cross-section, is designed specifically for gasoline engines and the claim is made that it can readily produce a 30-per cent gain in peak power output with current engines.

The design scheme is most simple and compact, this being attributed to the use of an internal water jacket surrounding the bearing area. Adoption of water cooling results from two compelling considerations. First of all it was found desirable to locate the carburetor

upstream from the compressor so as to eliminate the problem of a pressurized carburetor. Since less compressor work is required to compress a fuel-air mixture because of the lower ratio of specific heats, higher weight flows are possible. However, because of the consequent fuel addition in the stream, air from the compressor could not be bled off for cooling purposes.

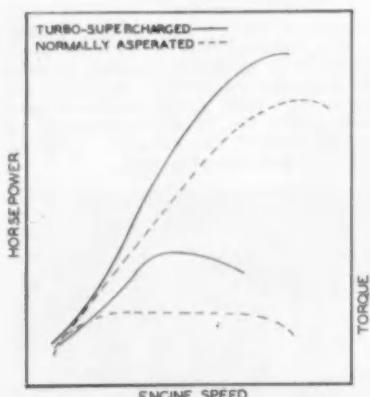
The second point is that initial work indicated that any attempt to use external air cooling or engine lubrication for cooling would result in a considerably larger assembly. Thus in this design water cooling has been found to be the most efficient means of extracting heat from the turbine section. Furthermore, tests have shown that the additional heat rejection to the engine cooling system is not sufficient to require a change in radiator size.

The two-bearing shaft assembly,

lubricated from the engine oil system, requires only modest rates of oil flow.

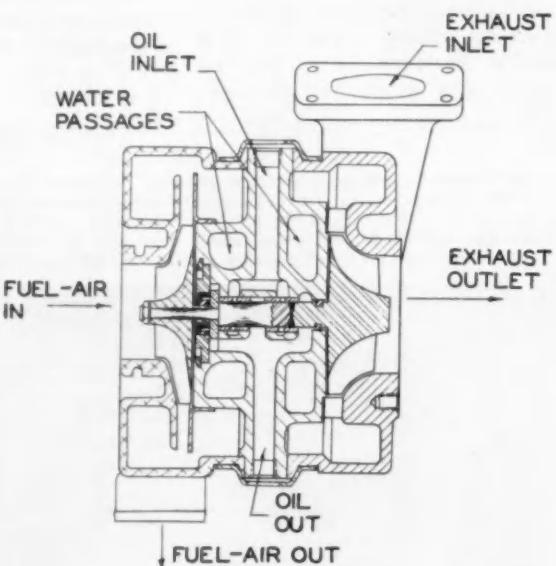
Maximum rotating speed is around 40,000 to 50,000 rpm, the compressor producing a pressure ratio of 1.5 to 1 at these speeds. Performance of the turbine wheel and compressor are directly dependent upon blade shape and curvature, diameters at the ID and OD, and wheel speed. Design of the nozzle and diffuser sections also plays a major role in determining overall efficiency. It can be appreciated that because of the fixed nozzle area and diffuser length in this unit, it can be designed specifically for only one area of the performance curve of the engine.

This feature may be seen in the figure which shows what can be expected when peak output of the turbocharger is tailored to produce maximum torque at the mid-speed



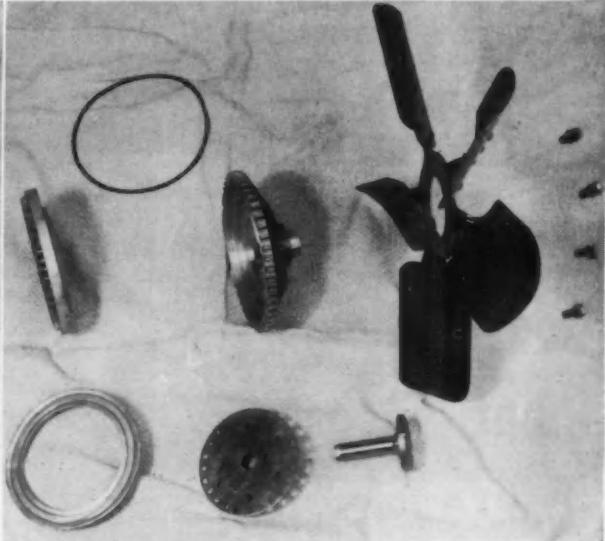
Engine performance curves illustrating the principle of tailoring the turbocharger to suit the needs of a specific installation.

Cross-section of T-P gasoline engine turbocharger, showing water-cooled construction which provides the heat dam between the hot and outlet ends of the unit.





Exploded view of the parts of the turbocharger, illustrating the simplicity of the arrangement.



Exploded view of the modulated fan, emphasizing its simplicity.

range of the engine. The marked change in slope of the torque and horsepower curves within this speed range results from restricting heat energy to the turbine wheel. This is accomplished by diverting a certain percentage of heat energy around the tribune.

To take another example, maximum horsepower could be obtained at maximum speed conditions by specifically designing the turbocharger to operate at rated speed. In this instance, however, the low speed performance would not be improved since mid-speed torque improvement would be correspondingly lower.

The second item to be described here is what is characterized as a low cost, speed and temperature sensitive fan which is offered for automobiles equipped with air conditioning. It is entirely self contained and will engage or disengage on demand, depending upon both temperature and speed conditions.

Fan performance is based primarily upon a viscous type clutch combined with a temperature sensing arrangement within the housing. The clutch plate is attached directly to the driving shaft and always operates at water pump speed.

The rotational characteristics of the housing depend upon fluid engagement between the housing and

the blade, clutch slippage being one of the controlling factors so far as speed sensitivity is concerned. Changes in temperature are employed to vary the volume of fluid between the plate and housing. As underhood temperature increases, a greater amount of fluid is permitted to remain in the clutch area, thereby maintaining the fan in engagement over the entire speed range of the engine, limited to the maximum set speed of the fan.

Similarly, when underhood temperature decreases, the amount of fluid fill in the clutch area is reduced, thereby reducing the coupling effect and correspondingly reducing fan speed to the minimum.

Since the device is of modulating type, fan speed at any time varies directly with engine speed and underhood temperature. The only limitation on this device is that it cannot function as a direct drive unit since it is physically impossible to engage the clutch plate with the clutch housing. This is not objectionable since in the majority of applications direct drive is not necessary to achieve high volume fan output.

Another important advantage of this type of fan is its effectiveness in reducing fan noise, because of actual disengagement under certain conditions. ■



View of modulated fan assembly shows the compactness of this new unit.

Metal Finishing in the Body-Building Plant

PART II



Cutting down orange peel in primer on wet deck using sand screen disk and flexible pad

THE tendency of the automobile industry to use less coated abrasives in the paint lines has been very evident in the last few years. Since this usage accounts for the greatest amount used in the building of a car, the savings have been considerable.

Generally speaking, when the production line is running near capacity, the abrasive cost per car is relatively high. Supervision is too busy to worry about a so-called minor cost like coated abrasives. The primary consideration is getting out the cars. When production is slow, time is available to pay more attention to costs, so the abrasive cost per car goes down.

Perhaps it would be advantageous to review the various ways in which this reduction in cost can be accomplished.

The base of an acceptable paint job is a smooth, clean body, free of dings, dents, deep file and disk marks, oil, excess sealers, and drawing compound. Considerable inter-departmental cooperation is necessary to constantly deliver good bodies to the paint line, but it can be done, and it will lower paint line costs considerably.

The spray booths are the next consideration. Properly designed

By R. D. Bottenfield
and F. J. Quinn

PRODUCT ENGINEERS

Quality Control Dept., Technical Branch
COATED ABRASIVE DIVISION

THE CARBORUNDUM CO.
Niagara Falls, N. Y.

booths that are provided with clean air will do much toward producing a dirt and dust-free finish. Properly maintained spray guns and careful spray operators can prevent much coated abrasives from being used to work out runs, sags, oversprays, and orange peel.

Drying ovens vary in type and include the infra-red, quartz tube, gas fired, and steam-heated models. The proper operation of these ovens relative to temperature and drying cycles is very important and closely tied in with abrasive costs. Variations in the drying cycle will affect the hardness of the dried enamel or lacquer. It is doubtful if many men sanding bodies will realize the difference in paint hardnesses which will occur if the ovens are not properly op-

erated. Their efforts will be about constant from body to body, and, if the paint varies in hardness, the re-work line gets the resulting improperly sanded bodies.

Another variable occurring in bodies is the difference in paint hardness due to paint color. Dark colors absorb more heat and dry faster and harder than the light colors. Therefore, the dark colors will cut down faster and, if the men sanding don't take this into consideration, there is more work for the repair line.

Proper storage conditions for coated abrasives is another area wherein savings can be realized. Rough, careless handling of cartons and sleeves of sheets can cause them to be damaged and discarded because of the damage. Coated abrasives are best stored at a temperature of 70F and 50 per cent Relative Humidity. This ideal condition is impossible to maintain unless an air-conditioned cabinet is provided. Some users of large amounts of coated abrasives have provided storage areas with controlled atmospheres in their store-room, and smaller controlled cabinets in the areas where the abrasives are used. Glue bonded products are affected to the greatest

Hand sanding on wet deck using 1/6 sheet of waterproof paper to attain maximum abrasive usage

extent by high humidity, and can be deteriorated to the point where the grain will strip easily. Conditions of low humidity have the greatest detrimental effect on resin bonded products causing them to become brittle. Points to watch relative to poor storage areas are: cartons stored on damp floors, and on racks near radiators, forced air space heaters, or steam pipes.

Control over the amount of abrasives used per day, per week, per car, or per shift is most important. There are many ways of achieving this control and the first step is to bring to everyone's attention on the line the fact that material is being rationed. Let them know what the daily allowance will be. Some plants have lockers on the line for each shift foreman where he keeps the week's allowance. He supplies his own crew only and picks up any left at the end of the shift. This practice, together with the habit of checking consumption several times during the shift, will give the foreman a constant check on usage and let the crew know he means business.

The size of sheet used for hand operations will vary from $\frac{1}{2}$ to $\frac{1}{4}$ 9 x 11 sheets on the wet deck down to $\frac{1}{6}$ and $\frac{1}{8}$ sheets for touch-up and re-work use. Half sheets, unless carefully used, are wasteful from our observations. Some plants have taken used sheets from the wet deck, soaked them to remove the loading, dried them, and then used them for touch-up and repair work, using these worn sheets in place of finer grits in the touch-up and repair lines. This may result in a saving, but considering the labor involved in this reclaiming operation, it seems in these times of higher labor costs to be a false economy.

The question of which abrasives to use for the various operations on the paint line is a touchy one. If everyone used the same paints, received equally good or poor

(Turn to page 126, please)



Hand sanding between color coats to remove imperfections and prepare for final color coat

Inspection and paint repair on final repair line



Building Industrial Engines at Caterpillar Plant

By Kenneth Rose
MIDWEST EDITOR

WHEN Caterpillar Tractor Co. set up production lines in its new 550,000 sq ft plant in Moline, Ill., a few months ago, it marked a move toward greater activity in its Industrial Engine Division.

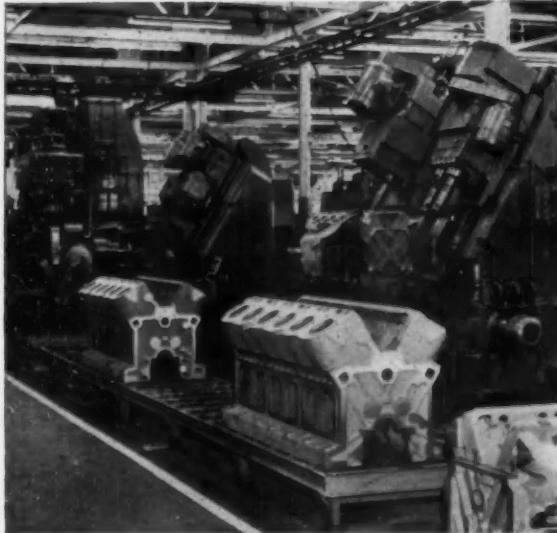
The new plant was built to fit the Industrial Engine Division into the Caterpillar organization. Caterpillar has taken advantage of the production facilities available, by designing a plant to be essentially a custom engine assembly plant. Except for the two

largest engines in the line, all engines turned out at the new plant are built as basic engines at the company's East Peoria plant, tested, and then transported to the new plant for modification into special types of power plants for industrial and marine application. The only production lines for basic engines at the new plant are those for machining the blocks of the V-8 and V-12 engines.

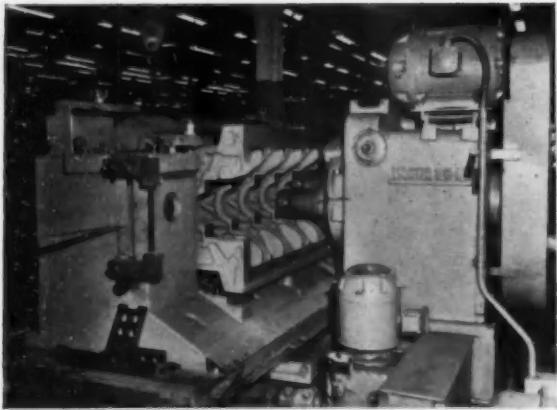
Including the two V engines, the division offers a wide variety of engines in 13 size ranges. There are about 25 basic types and within this group are about 125 configurations, and options in such variety as to make the output practically custom-built to the purchaser's specifications.

This has determined the layout and planning of the new plant. It has two assembly lines, one of which accommodates the new V-8 and V-12 engines of 5½-in. bore, and the engines of 6¼-in. cylinder bore, and the other line takes all other engines. The reason for putting the 6¼-in. bore engines, which come to the plant as basic engines, on the same line as the

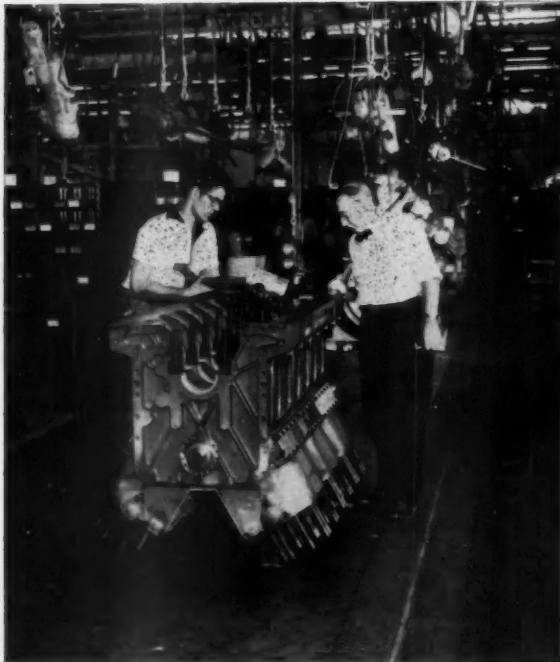
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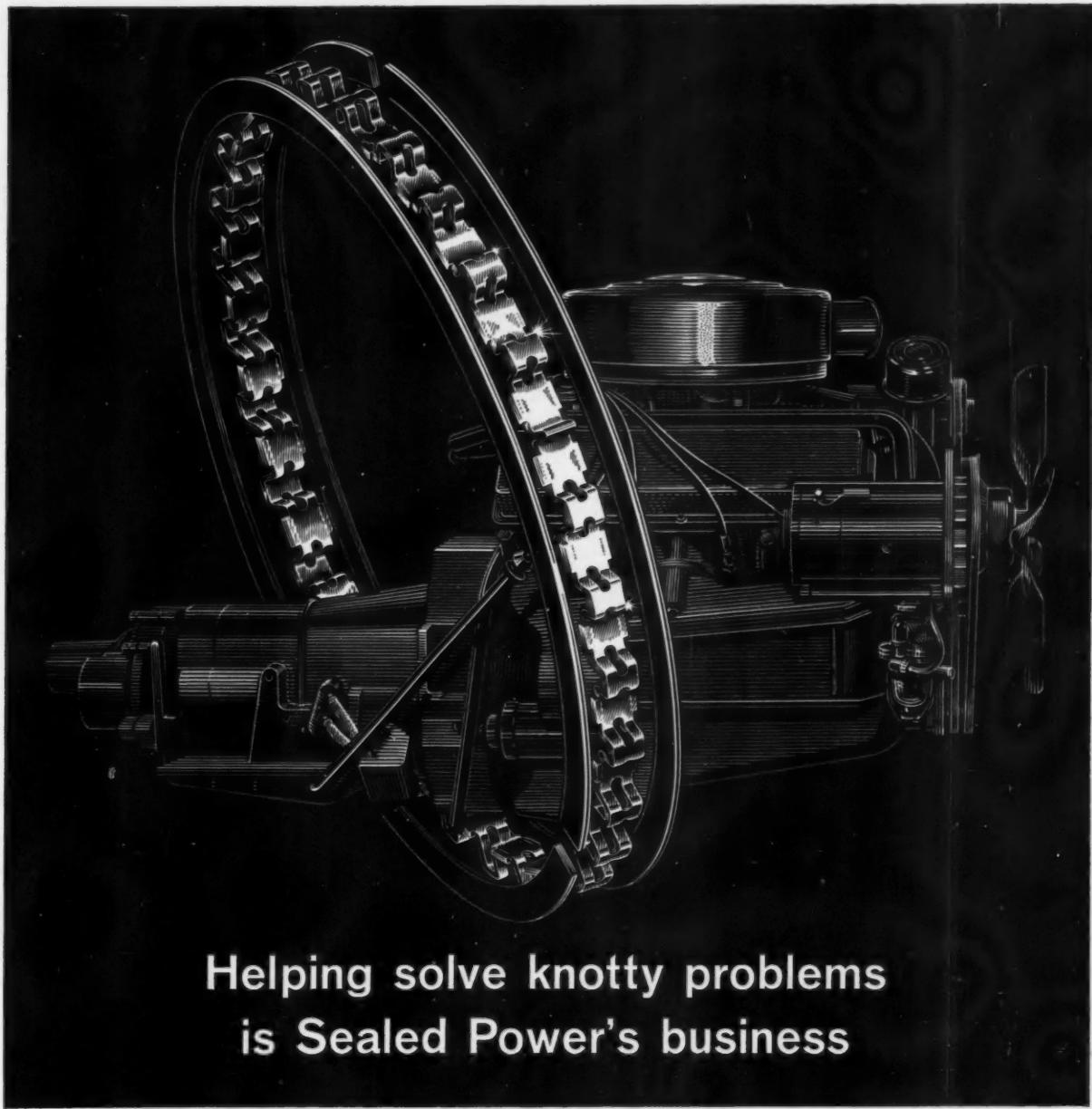
Cylinder blocks for the V-8 and V-12 engines are machined at the new plant.



With the block held in a fixture, pan rails and bearing locks are milled.



Engine assembly lines are flush with the floor.



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• • INDUSTRY STATISTICS • •

By Marcus Ainsworth

STATISTICAL EDITOR

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Vehicle Make	Weeks Ending		Year to Date	
	May 28	May 21	1960	1959
PASSENGER CAR PRODUCTION				
Total—American Motors.....	9,093	11,018	224,007	178,966
Chrysler.....	1,828	1,843	40,380	36,162
De Soto.....	296	267	14,753	25,962
Dodge.....	9,374	11,373	169,249	79,388
Imperial.....	408	—	7,534	6,972
Plymouth.....	4,202	4,098	125,874	204,904
Valiant.....	7,442	7,576	122,077	—
Total—Chrysler Corp.....	23,550	25,158	499,847	356,388
Comet.....	4,929	5,516	55,494	20,724*
Falcon.....	10,866	10,532	216,450	—
Ford.....	19,978	20,533	488,392	883,227
Lincoln.....	291	346	10,028	14,159
Mercury.....	3,085	3,074	79,671	69,957
Total—Ford Motor Co.....	39,159	40,401	850,025	786,067
Buick.....	6,784	7,348	138,544	123,198
Cadillac.....	3,380	3,434	74,787	74,524
Chevrolet.....	37,875	39,556	807,779	738,033
Corvair.....	4,039	4,056	131,948	—
Oldsmobile.....	7,270	8,757	160,254	168,534
Pontiac.....	16,500	11,014	212,158	200,971
Total—General Motors Corp.....	69,056	74,966	1,543,050	1,325,260
Total—Studebaker-Packard Corp.....	—	2,623	53,207	77,341
Checker Cab.....	196	209	3,374	2,528
Total—Passenger Cars.....	142,456	154,975	3,173,528	2,728,550

TRUCK AND BUS PRODUCTION

	March	February	March	
	1960	1960	1959	1960
Chevrolet.....	8,001	8,338	205,816	175,331
G. M. C.....	2,630	2,317	49,876	38,854
Odomand T.....	70	65	1,286	2,845
Dive.....	100	100	1,932	1,988
Dodge and Fargo.....	1,779	1,789	34,653	36,383
Ford.....	8,084	8,130	166,053	145,440
F. W. D.....	20	9	470	419
International.....	2,626	2,680	55,239	61,684
Mack.....	300	351	6,250	7,453
Studebaker.....	67	516	6,623	5,805
White.....	385	406	8,238	8,334
Willys.....	5,610	3,513	63,577	50,972
Other Trucks.....	95	95	1,805	1,656
Total—Trucks.....	28,769	28,279	604,816	536,766
Buses.....	65	103	1,709	1,193
Total—Motor Vehicles.....	172,290	183,357	3,779,853	3,266,509

* Edsel production

1960 TRUCK TRAILER SHIPMENTS

Industry Division, Bureau of the Census

Vane	Type of Trailer	March	Three Months	
			1960	1959
Vane	Insulated and refrigerated.....	568	1,688	1,317
	Steel.....	110	281	160
	Aluminum.....	488	1,407	1,167
Furniture	202	516	350	
	Steel.....	171	462	280
	Aluminum.....	31	56	70
All other closed-top.....	2,851	8,575	6,359	
	Steel.....	720	1,264	1,054
	Aluminum.....	2,131	6,711	4,482
Open-top.....	312	913	537	
	Steel.....	92	296	203
	Aluminum.....	220	627	334
Total—Vans.....	3,933	11,094	8,540	
Tanks				
Non- and low-pressure				
Petroleum and aircraft refuelers				
Carbon and alloy steel.....	172	473	616	
Stainless steel.....	32	74	61	
Aluminum.....	157	494	393	
Total—Petroleum.....	301	1,041	1,070	
Chemical, food, and sanitary.....	56	172	99	
Dry materials.....	143	315	299	
High-pressure (LPG, chemicals, etc.)	23	79	106	
Total—Tanks.....	583	1,607	1,576	
Pole, pipe, and logging				
Single axle.....	13	67	75	
Tandem axle.....	94	232	188	
Total.....	107	299	264	
Platforms				
Racks, livestock, and stake.....	24	73	120	
Grain bodies.....	180	477	392	
Flats, all types.....	1,161	2,883	2,296	
Total—Platforms.....	1,386	3,413	2,508	
Low-bed heavy haulers.....	244	548	613	
Dump trailers.....	146	354	580	
All other trailers.....	433	1,015	661	
Total—Complete Trailers.....	6,811	18,920	15,052	
Dump trailer chassis ¹	70	242	—	
Trailer chassis only ¹	401	865	1,318	
Total—Trailers and Chassis.....	7,282	20,027	16,370	
Detachable van bodies ¹	210	639	749	

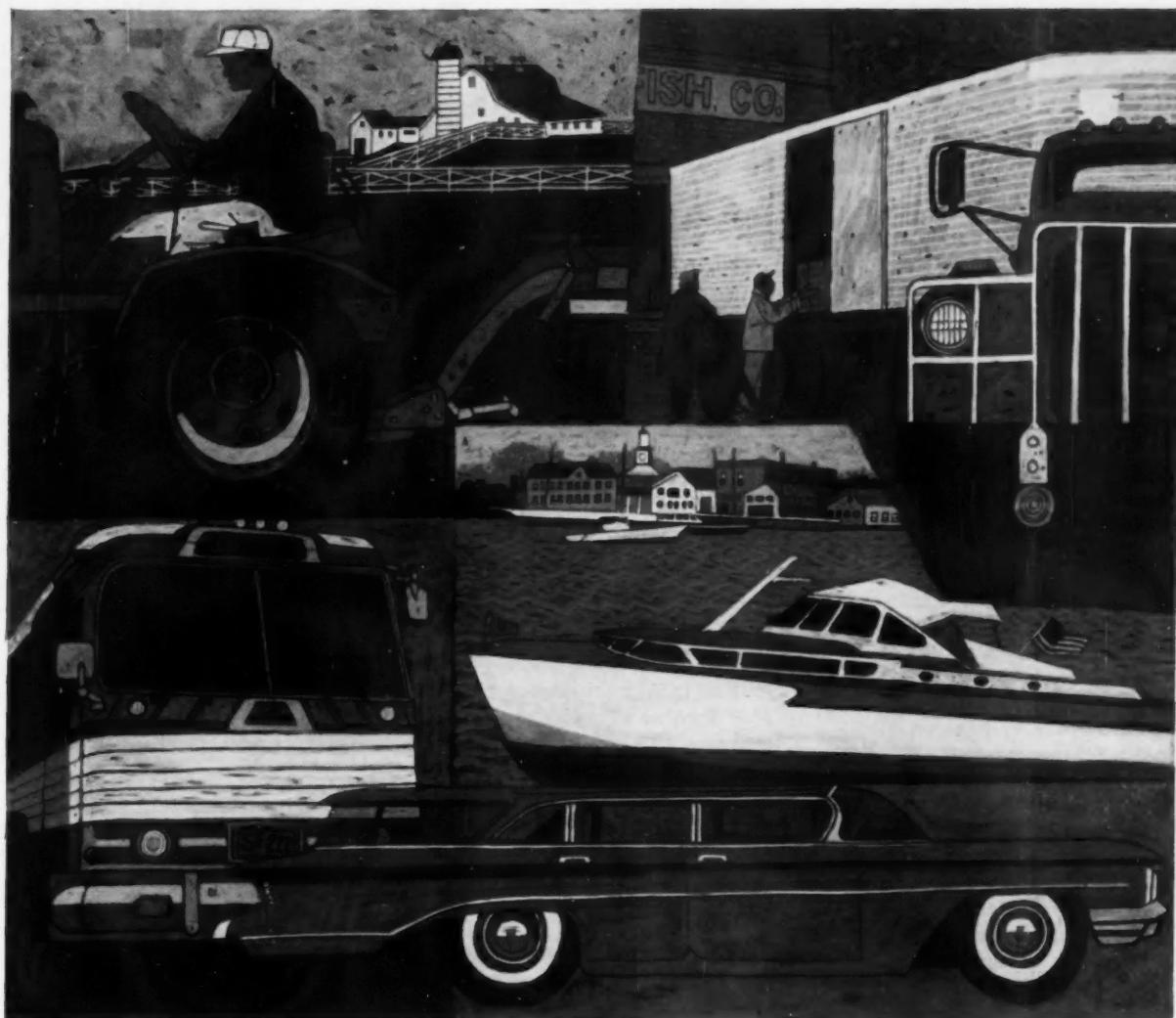
¹ Sold separately.

NEW PASSENGER CAR REGISTRATIONS BY REGIONS

Zone	Region	March 1960	February 1960	March 1959	Per Cent Change		
					1960	1959	Mar. over Mar. 1959
1	New England.....	30,046	25,177	25,429	75,498	58,078	+19.37
2	Middle Atlantic.....	100,628	96,218	93,025	278,553	236,478	+13.94
3	South Atlantic.....	78,519	64,221	66,650	208,622	106,302	+22.26
4	East North Central.....	151,655	121,761	124,219	387,881	326,698	+24.53
5	East South Central.....	31,321	25,333	24,838	75,485	64,574	+23.64
6	West North Central.....	50,438	40,355	39,186	123,362	115,691	+25.05
7	West South Central.....	50,453	41,293	42,442	127,011	123,852	+22.18
8	Mountain.....	19,201	15,826	17,429	50,879	50,699	+21.33
9	Pacific.....	75,406	63,999	64,435	182,892	181,135	+17.82
Total—United States.....		596,669	494,178	497,651	1,520,963	1,343,497	+20.74
							+19.90
							+13.21

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Id., Mont., Nev., N. M., Utah, Wyo. Zone 9—Alas., Cal., H. I., Ore., Wash.

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PRESSURE MONITORING PROBLEM? SEE AC!



New AC pressure switch
—newest AC design for
superior pressure
monitoring reliability.

If you have a problem in the field of pressure switches for the monitoring of air or hydraulic pressures, contact AC. AC has been in the pressure switch business for years and years and AC has paced the industry in the development of pressure switches of even better reliability, efficiency and economy.

AC's leadership in pressure switch engineering is underscored by AC's most recent design—a slack diaphragm switch that sets new standards of reliable, efficient, economical performance.

This improved switch . . . increases cycle life from 500,000 to 1,000,000 cycles . . . holds closely to calibration limits for positive control of diaphragm compression and maximum sealing . . . overcomes temperature expansion shrinkage by using a metal crimp ring instead of phenolic molding compound as part of the sealing construction . . . has stamped shell for slip-proof wrench attachment.

Unlike previous designs and many current "improved" designs, this AC pressure switch functions efficiently under such adverse conditions as dirty oil and high temperatures. It efficiently and effectively shows pressure rise and fall between 3 and 30 p.s.i. in cars, trucks, tractors and inboard-engine power craft. It uses standard pipe sections for connecting to oil galleries and is available in many variations of length, thread diameter and thread size, permitting purchase and use at minimum tooling costs.

If you want to know more about this new AC pressure switch or have problems in the field of pressure monitoring, get in touch with the nearest AC office. AC sales engineers and pressure switch specialists are as close at hand as your post office, telegraph office or telephone.

AC Reliable Products Help You Sell



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Highway, CEDAR 4-5611	Avenue, ROgers Park 4-9700	Bldg., TRinity 5-9197	Ridge Rd., EDison 1-8622	RAymond 3-5171	MOhawk 4-9722, Bala Cynwyd

News of the MACHINERY INDUSTRIES

By Charles A. Weinert

While April Orders for Machine Tools were Substantially Below Those in March, the Four-Month Record This Year Indicates that 1960 Sales Will Be Well Over Last Year's

Machine Tool Orders Dip Down in April

Net new orders for metal-cutting machine tools dropped an estimated \$11.7 million in April from the March volume, while metal-forming machine net orders rose an estimated \$1.4 million.

Preliminary figures from the National Machine Tool Builders' Association indicate the April metal-cutting net order total was \$36.75 million and the metal-forming machine total \$14.9 million, for a combined \$51.65 million.

In March the corresponding final figures were respectively \$48.45 million, \$13.5 million, and \$61.95 million.

In April 1959 the combined net new order total was \$53.2 million.

Foreign orders, incidentally, still represent a sizable portion of incoming orders. During April 1960 the preliminary figures were \$8 million metal-cutting and \$3.85 million metal-forming, for a combined foreign order total of \$11.85 million.

Shipments in April were likewise lower than the volume in March, being estimated at \$55.35 million for both types of machines, compared to March's \$64.5 million. However, the volume in April compared favorably with January's \$46.4 million and February's \$51.95 million, and with April 1959's \$45 million.

Ludlow King, NMTBA executive vice-president, made the following comments when transmitting these latest statistics:

"Shipments of cutting type machine tools in April totaled \$44.3 million, which brings the total figure for the first third of 1960 up to \$172.1 million. This is at a yearly rate of \$516.3 million, as

compared to shipments of \$413.05 million for 1959.

"Net new orders of cutting type slipped to \$36.75 million in April—however, in studying the . . . constant improvement since the third quarter of 1958, it is felt this monthly drop is not too significant.

"Shipments of metal forming type machine tools totaled \$11.05 million in April, bringing the first four months of 1960 up to \$46.1 million. This gives a yearly average of \$138.3 million as compared to 1959 shipments of \$125.1 million. Net new orders of forming type advanced to \$14.9 million, which is the second best month since December 1956."

Tax Depreciation

During one of the sessions at the American Machine Tool Distributors' Association meeting (AI May 15), Joel Barlow of Covington & Burling, Washington, D. C., made some interesting observations in connection with tax depreciation. We believe they are worth passing on.

He said that the IRS had recently issued a ruling to the ef-

fect that a company using production-line machine tools can obtain a more rapid writeoff than heretofore by making a general case for a more active replacement program in the future. This will then permit an annual average rate of 7 per cent—instead of a 4, 5 or 6 per cent rate—with a complete writeoff in 14-2/7 years. Further, by using the double-declining-balance or sum-of-the-digits method, the writeoff the first year can be on the order of 14 per cent.

Mr. Barlow also said that members of Congress now agree there should be depreciation reform—that he felt confident industry will get reform legislation—but that action will be deferred until next year.

Around the Industry

Burg Tool Mfg. Co.—has placed an order with Hughes Aircraft Co. for an unrevealed number of numerical controls, valued at \$120,000. The Hughes units will be used on Burgmaster turret drills and be marketed by Burg as complete systems. The controls

(Turn to page 114, please)

METAL CUTTING AND FORMING MACHINE TOOLS

Net New Order Receipts, and Shipments

(Millions of Dollars)

1960	Net New Orders			Shipments		
	Cutting	Forming	Total	Cutting	Forming	Total
Jan.	\$43.45	\$13.00	\$56.45	\$36.75	\$ 9.65	\$46.40
Feb.	47.70	12.90	60.60	40.00	11.95	51.95
Mar.	48.45	13.50	61.95	51.05	13.45	64.50
Apr.	36.75*	14.90*	51.65*	44.30*	11.05*	55.35*
4 mos. '60	176.35*	54.30*	230.65*	172.10*	46.10*	218.20*
Annual Rate	529.05	162.90	691.95	516.30	138.30	654.60
Year 1959	509.00	149.95	658.95	413.05	125.10	538.15

* Preliminary.

Source of Statistics: National Machine Tool Builders' Assn.

Want to Convert Rotary Motion into Linear?



The **EATON** **OVERRUNNING** **BALL-SCREW** *may be your answer*

The Eaton Overrunning Ball-Screw is a simple, versatile mechanism that converts rotary motion into linear. In such basic applications as actuators for opening doors and windows, and positioners of various kinds this device offers the designer many advantages:

- Nut stops at end of travel, and overruns without jamming
- No limit switches or anti-stall devices are required
- High mechanical efficiencies reduce power requirement
- Can be installed in inaccessible or sealed-in locations for remote control operation
- Permits compact, space-saving assemblies

The Eaton Overrunning Ball-Screw may be adapted to an almost endless number of applications. Send for illustrated descriptive literature.

SOME POSSIBLE APPLICATIONS

- Window Lifts
- Seat Actuators
- Trunk lid lifts
- Die table positioners
- Door controls
- Convertible top lifts
- Chair Adjusters
- Speed control devices
- Mechanical toys
- Business machines
- Surgical and hospital equipment



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**Review of
NEW
PRODUCTS**

DESIGN ENGINEERING SHOW

at the

Dry Bearings

Two new dry bearings were displayed at the show. One of these bearings is being used in the Rolls Royce. It requires no lubrication of any sort but depends upon a combination of Teflon and finely divided lead for its exceptional anti-friction properties. The second bearing has been developed by NASA for use in space vehicles. It employs a film of lead monoxide whose anti-friction properties increase with temperature up to 1000 deg F. Top operating temperature for the bearing is 1250 deg F and it will operate well at high speeds and under heavy loads. *Lead Industries Association.*

Circle 70 on postcard for more data

Electric Motion Control

Three new products to provide electric motion control for various types of machinery were displayed at the show. First was a new spline drive armature especially suited to clutch and brake applications where shock, vibration and severe duty are present. Second was a clutch-pulley package for direct installation on standard NEMA electric motor shafts.

The final item featured was a line of miniature electric clutches and brakes that were designed to handle torque loads up to 1.5 lb in. *Warner Electric Brake and Clutch Co.*

Circle 71 on postcard for more data

Aluminum Parts

Precision aluminum parts for high temperature service can be formed by a newly developed process that was shown at the design show. Parts made by this process, an aluminum powder metallurgy impact extrusion, are known as Alcoa APM Impacts.

According to the manufacturer, prototypes that were displayed could not be manufactured by any other process.

Contrasted with the general application of the powder metallurgy

technique to other metals—which involves sintering of metal powder directly into finished form—the Alcoa aluminum powder metallurgy impact employs powder metallurgy techniques to form the slug from which the final form is impacted. Result is to elevate the upper operating temperature limits for high-strength parts fabricated from these APM slugs. *Aluminum Co. of America.*

Circle 72 on postcard for more data

New Material

A new abrasion resistant material, known as Uscothane, was displayed at the Design Engineering Show. One of the first applications of this material was on the unique Curtiss Wright air car. The manufacturer reports that this material has lasted for more than three months of



rugged testing on the air car. The working range of this material is from 250 deg F down to -30 deg F. In wet service, the upper range is 160 deg F.

In addition, special compounds and ways of preparing the new material are offered to industrial users and designers who work with the rubber company's development men. Uscothane can be supplied already adhered to almost any fiber stock or fabric as well as many metals in

sheet or shaped forms. Successful metal-backed constructions already have been made using aluminum, cast iron and steel. *United States Rubber.*

Circle 73 on postcard for more data

Silicones for Engineering

How silicones simplify design was illustrated by the Dow Corning exhibit at the Design Engineering Show. Examples of typical applications for silicones demonstrate how these unusual engineering materials are being used to improve and extend the performance of original equipment.

Silicones have gained an enviable reputation of reliable service under rugged conditions. Silicone fluids, for example, experience very little change in viscosity over wide temperature spans. Rigid laminates and molded parts made with silicone resins retain physical strength and dielectric properties at high temperatures and humidity. Silastic, the Dow Corning silicone rubber, remains flexible in sub-zero environments and will not burn, char, or become gummy in continuous service at temperatures up to 500 F, according to the manufacturer. *Dow Corning Corp.*

Circle 74 on postcard for more data

Structural Adhesives

Among the products featured at the show were Scotch-Weld Brand thermo-setting film, and one-part heat curing, and two-part chemically curing liquid, modified epoxy adhesives. Typical bonded parts such as castings, tubing, gear and shaft assemblies, metal shipping containers, rotor blades, etc., illustrated how structural adhesives are used to solve design and assembly problems. They were displayed together with proper design methods and typical joint designs for structural adhesive bonding. *Minnesota Mining and Manufacturing Co.*

Circle 75 on postcard for more data

**AUTOMOTIVE
INDUSTRIES . . .**
*is your News Magazine of
Automotive and Aviation
MANUFACTURING*

NEW

PRODUCTION and PLANT

EQUIPMENT

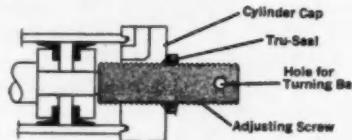
By C. J. Kelly
ASSISTANT EDITOR

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Adjusting Screw

A THREADED adjusting screw quickly sealed and unsealed, with an ingenious threaded fitting is the simple device now offered for rapid, easy adjustment of cylinder strokes.

The adjusting screw is installed in the cap end of the power cylinder. Turning it clockwise causes it to enter the cylinder bore, where it acts as a solid "stop" to limit the stroke to exact length desired.



A Teflon-sealed Tru-Seal straight thread fitting seals the adjusting screw against air or oil leakage from the cylinder and keeps the adjusting screw securely locked in position.

The cap end stroke adjustment is available in all bore sizes of Miller air and hydraulic cylinders. *Miller Fluid Power Div., Flick-Reedy Corp.*

Circle 43 on postcard for more data

Spot Welding Unit

A NEW metal-insert-gas-shielded-arc spot welding unit has been added to a line of automatic and semi-automatic arc welding equipment.

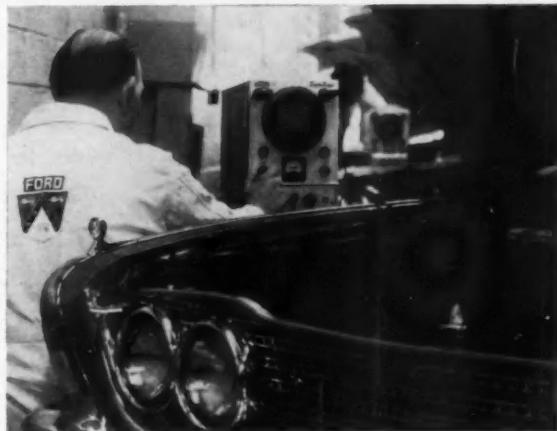
With this unit, mild steel, galvanized carbon steel, stainless, aluminum and other metals 0.030 to $\frac{1}{4}$ in. can be spot welded from one side only. The unit can also be used to plug weld metals $\frac{1}{8}$ in. thickness and greater. Space welding (where there is a void space between top and bottom sheets), tack welding (to hold various parts in subassembly or final assembly operations), and bead welding (manually guided semiautomatic welding various joints and seams) can also be accomplished.

According to the manufacturer the equipment is capable of producing over 20 spots per minute using carbon dioxide, argon, helium, and other gas-shielding mixtures depending upon

The Ford Motor Company as part of an intensified quality control program is now utilizing Du Mont's supercan TV-type engine analyzer, the 901 EnginScope, after final assembly at all United States plants which assemble Ford automotive vehicles. Ford, Falcon, Mercury, Comet, and Lincoln engines are checked on a quality sampling basis following final vehicle assembly at each plant.

Circle 42 on postcard for more data

Quality Control Operations at the Ford Plant



THE engine of each assembled vehicle which is scope tested is analyzed to find in a matter of seconds all types of ignition malfunction as outlined by the final vehicle evaluation manual used by the *Ford Quality Control Department*.

A primary purpose for scope testing of engines at Ford is to pinpoint trouble accurately and quickly so that faults can be traced to the correct

place of origin, i.e. engineering, faulty items from vendors, or improper production handling.

Du Mont engineers point out that the EnginScope is used for factory quality control testing, in dealers' service shops, and by independent garages and service stations for fast, profitable engine and ignition analysis. *Allen B. Du Mont Laboratories, Inc.*

welding application. Because of a minimum of weld spatter, metal cleaning is usually unnecessary. *Hobart Brothers Co.*

Circle 44 on postcard for more data

Automobile Tractor

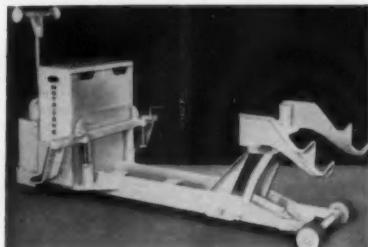
A N electric powered tractor has been specifically designed for use in the automobile final assembly plant. This unit has been named the Walkie.

Ordinarily, autos are driven away from the final assembly lines under their own power. If a car fails to start, however, the tractor lifts the front of the stalled vehicle and tows it away from the congested area.

An extended frame and padded fixtures on the lifting mechanism allow automobiles to be raised from axles, bumpers or frames. Capacity of the

tractor is 4,000 lb; lifting range is 14 in.

Powered by either a 12-volt or an 18-volt battery, the truck offers more efficient operation with two speeds



forward and two reverse. Safety features include a spring-return handle which cuts off power and applies the brakes when the handle is released. *Moto-Truk Co.*

Circle 45 on postcard for more data

NEW PRODUCTION and PLANT EQUIPMENT

New Arc Torch

A NEW, versatile arc torch has been designed to enable existing arc welding equipment to take on jobs formerly done only with gas. It creates intense heat electrically, and does not exert pressure which could displace molten metal or produce blow holes in thin gauge metal.

The torch can be used for welding, brazing, general heating or preheating prior to welding, soldering, and hard surfacing.

An AC model is available complete with two 10 ft cables, four $\frac{1}{8}$ in. carbons, four $\frac{1}{4}$ in. carbons, and adaptors for $\frac{1}{2}$ in. carbons. The DC model is supplied with two 10 ft. cables, two $\frac{1}{8}$ in. carbons, four $\frac{5}{16}$ in. carbons, two $\frac{1}{4}$ in. carbons, and adaptors for $\frac{1}{2}$ and $\frac{5}{16}$ in. carbons. *Metal and Thermit Corp.*

Circle 46 on postcard for more data

All Parts Can Be Deburred in Mechanical Vibrator

VIBRATOR finishing, a process developed within the last five years, has proved to be a "natural" for mechanical deburring. Shown is model 2642, it features a 5.7 cu ft load capacity.

An analysis of Lorco vibrator equipment installed by Lord Chemical Corp., which recently has been affiliated with Wheelabrator Corporation, reveals seven out of 8 Lorco vibratory installations are for deburring.

In some instances, the vibratory equipment accomplishes other steps as well, such as polishing or descaling, but in 36 of 43 installations covering more than 50 vibrators, deburring is one of the purposes for which the

Particle Inspection

MODEL AH-7 is a newly developed magnetic particle inspection machine that has been developed to find cracks in cylinder heads, engine blocks, connecting rods and other metal components that require rigid inspection. This portable unit weighs 120 lbs and measures 13 by 13 by 38 in. high. It may be used with wet or dry methods, and may also be employed in limited demagnetization operations. *The Sperry Products Co.*

Circle 47 on postcard for more data

drilling, grinding, shaping, slotting and boring operations without additional set-ups. Completely portable, they can also be taken to the workpiece for in-place machining of components too large for machining in ordinary machine tools. Versa-Mils are also used as machining heads in various types of production set-ups. Two new units, designated as Models 1 and 3, expand the range of Versa-Mil application to include light, medium and heavy operations. *The Dunmore Co.*

Circle 48 on postcard for more data

Portable Machining Unit

Versa-Mil machining units are designed for use in lathes or other machine tools to perform milling,

Rotating Air Cylinder

To meet the need for greater spindle speeds on modern metalworking machines, The S-P Manufacturing Corporation is introducing its new Model RM Rotating Air Cylinder, designed for use at speeds up to 3600 rpm.

Built with housings and covers of aluminum alloy precision-machined to mirror-finish inside and out, the low weight of this new rotating cylinder and its lessened flywheel effect reduce the load on the machine's motor, clutch and brake, cutting operating and maintenance costs. This new Model RM cylinder also features a special double bearing inlet to give longer life at higher speeds and faster operating response. Its special inlet packing adjusts itself automatically through working pressure, further reducing maintenance and increasing its years of dependable service.

Available in 3 to 16 in. bore sizes, all Model RM cylinders have extra long stroke, giving a bonus of power when serving as actuators for chucks, collets and other rotating holding devices. *The S-P Mfg. Corp.*

Circle 50 on postcard for more data



Model 2642 Lorco vibrator finishing machine with 5.7 cu ft load capacity

Drill and Tap Machine

Two speed horizontal opposed drilling and tapping machines have been designed to permit magazine of hopper feed at a high rate of production and include flexibility of application. With this unit a combination of operations is possible. Such as: Drilling and counterboring; threading both ends; double chamfering; double end centering. *Universal-Automatic Corp.*

Circle 51 on postcard for more data

Operation Programming

DRILLING, tapping, reaming, boring and straight-line milling operations are fully controlled and programmed by a new line of numerically controlled drilling machines. These new machine tools permit spindle speed, feed rate and depth settings to be fully controlled by both tape and dial along with conventional x and y coordinates. Any combination of these three settings may be selected for any spindle at any time, permitting a given tool to be programmed to varying levels and varying depth of holes, all on the same work piece.

Jigs and fixtures are completely



eliminated, accuracy and speed of actual machining operations are reported to be improved. Holes can be located and drilled to accuracies of 0.001 in. per foot, with production of up to 15 holes per minute on continuous fully automatic operation.

The dial control panel and tape reader are mounted integrally with the machine. The tape reader uses either a 4 in. direct reading decimal-coded plastic tape or Flexowriter 1 in. paper tape. *Hillyer Corp.*

Circle 52 on postcard for more data

Ceramic Powders

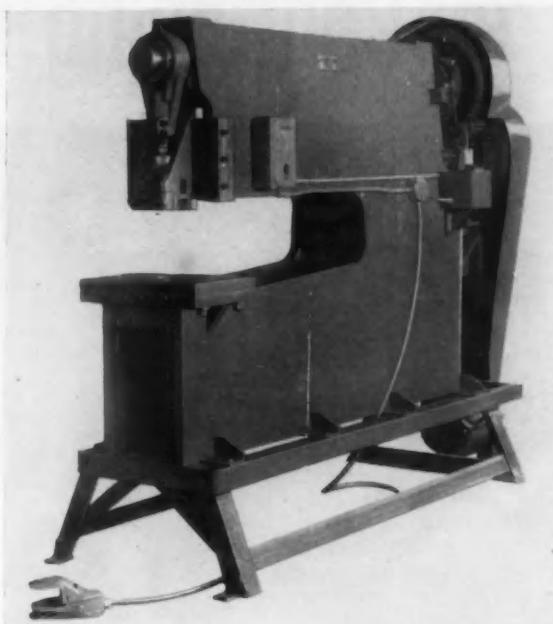
TWO new ceramic powders have been developed for applications in tools, jigs and fixtures, where shaping of exotic metals requires great heat and pressure. Some of the features of these new powders, named Corcast and Cortamp, are: They can be formed to the desired shape; no separate firing is required. Bonding occurs in use; and temperature capabilities go up to approximately 2500 and 4000 deg F. *Corning Glass Works.*

Circle 53 on postcard for more data

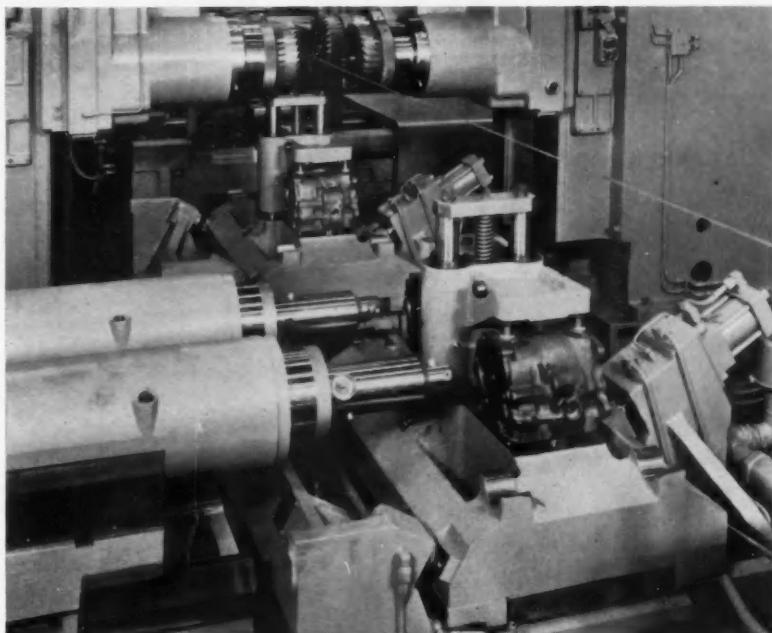
Heavy Duty Power Punch Press With 40 Tons Capacity

A recently developed punch press features a 36 in. throat depth that is completely useable. It is designed without tie-bars or other strengthening devices that would limit the throat capacity. Among other features on this unit is a solenoid operated pin-type, non-repeat clutch that can be converted to repeat. The electric motor for this press is available in 220-440 or 550 V with a 60 cycle current. Throat height is 12 in. with 84 strokes per minute. *Whitney Metal Tool Co.*

Circle 54 on postcard for more data



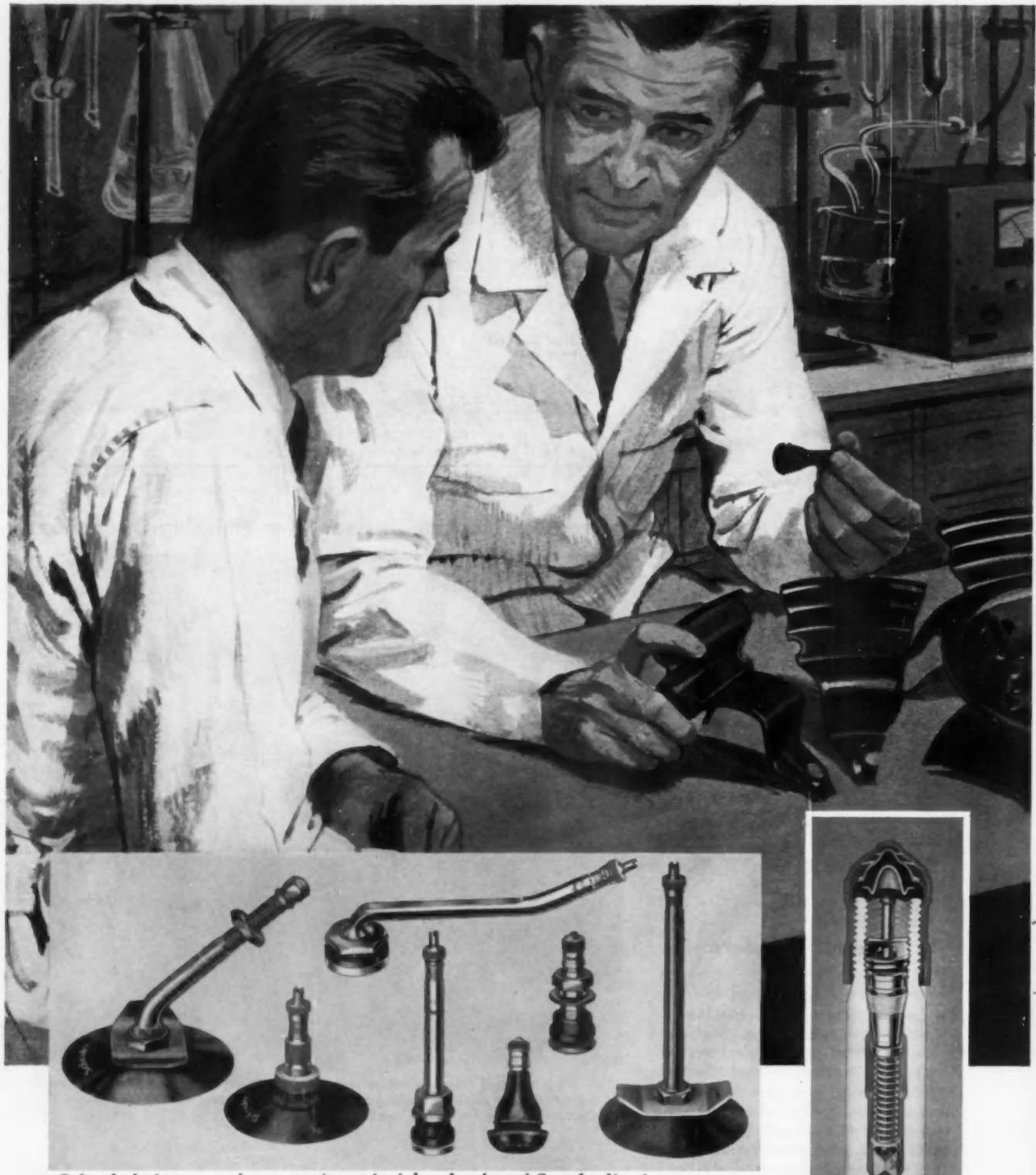
Transfer Machine Designed for Finishing Operations



A newly designed transfer machine is reported to be capable of holding tolerances of 0.00035 in high-precision finishing operations with the production economy gained from automation. The five station machine has a production rate of 140 pieces per hour. *The Cross Co.*

(Turn to page 94, please)

The American Automotive Industry—the world's
Continuing Research works to



*Schrader's famous valve operating principle—the Ace of Standardization
—through a program of continuing research on all types of standard tire valves.*

greatest enterprise—depends on tire accomplishments

deliver the highest quality valve at the lowest possible price



RUBBER MUST STAND HEAT. Both climatic and brake drum heat can get high enough to weaken and destroy a tire, or shorten its life.



RUBBER MUST STAND ABUSE. Dirt, pressure, bending, shock, chemicals, ozone, moisture condensation . . . just a few of the things that work against tires.



KNOWLEDGE of rubbers for tires and tire valves are closely related, so both industries work together on extremely difficult problems.



STANDARDS ARE HIGH because the Automotive, Tire, and Tire Valve Industries make them high—to the benefit of every vehicle everywhere.

In the Automotive, Tire and Tire Valve Industries, research will never stop. Improvements are being made continually. This means each vehicular part, material, or function must constantly be examined and re-examined in relation to every other part, material, or function. As an example, superb types of tires are now in use which would have seemed incredible only a few years ago. And still research in rubber chemistry continues! Right now, Schrader specialists are contributing one improvement after another in valve design, ingredients and practical adaptions to hundreds of wheel sizes and types. Their aim: Ever better tire valves—ever more practical and dependable—to match and serve any vehicle that comes off the production line.

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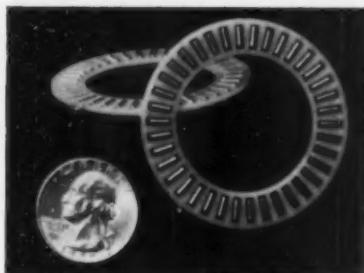
By C. J. Kelly

ASSISTANT EDITOR

New Needle Bearing

An improved type of needle thrust bearing using a glass fiber filled nylon retainer has been introduced.

The new bearing, type "NJ," employs a nylon retainer that reduces



undesirable sliding friction inherent in the all-steel type of needle thrust bearings. The use of nylon also provides greater life with negligible retainer wear.

This new injection molded retainer has an exceptionally high strength and stability. The inherent qualities

of nylon are also present, including low friction, light weight, non-magnetic, and noise dampening features.

Thrust capacity of the new bearing is equal to or greater than the capacity of all-steel bearings, and the permissible operating speeds are greater.

Extensive testing in both the laboratory and field have proved this needle bearing very efficient, according to the manufacturer. Another feature of this development is the different colors that can be used to manufacture it. This could serve as a rapid identification system. *The Kaydon Engineering Corp.*

Circle 55 on postcard for more data

New Transmission

A new heavy-duty transmission has been designed for application with Diesel engines up to 525 gross hp. Named the CLBT-5940, this unit features a three-element torque convert-

er that has a stall torque ratio of 2.5 to 1. It employs "split range" automatic valve body that in essence provides 12 phases to shifting of the transmission. These are controlled by the usual four speed lever, providing driver control for each range.

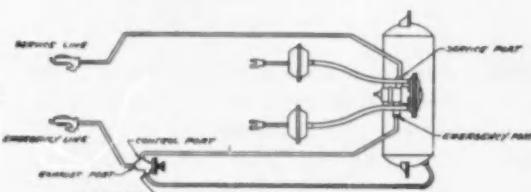
Incorporated as a new engineering feature is the "auto-flow" cooler circuit that takes advantage of torque converter characteristics to increase the flow of the cooling oil. This will make possible use of the full brake for much longer periods on standard grades, while at the same time reducing oil temperatures. *Allison Div., General Motors Corp.*

Circle 56 on postcard for more data

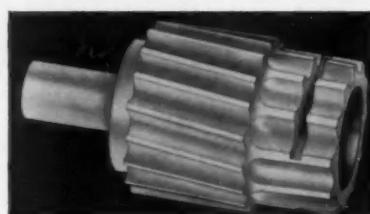
Molded Nylon Gear

A nylon gear has been designed to help measure the economy miles as they are rolled up on the Ford Falcon. This unit is installed in the automobile transmission and operates the speedometer through the cable assembly. The gear is designed and molded

Auxiliary Control System for Trailer Brakes



The operation of this new brake system is as follows: The supply port is piped to the trailer reservoir. The exhaust port of the valve is piped to the emergency line. The control port is piped to the emergency port of the emergency relay valve.



for precision performance, according to the manufacturer, to give accurate readings which are important to the owner as well as the Falcon people. *The Danielson Mfg. Co.*

Circle 58 on postcard for more data

Rubber Adhesive

Silastic 140 is the name of a new rubber silicone adhesive that has been designed to splice rubber parts, or bond them to other material such as metals, plastics or ceramics. It is a ready-to-use material and can be used in the field or shop. *Dow Corning Corp.*

Circle 59 on postcard for more data

An auxiliary control for trailer brakes provides a means of applying or releasing trailer brakes where the trailer has air pressure but is disconnected from the tractor. With the auxiliary control, parked trailers may be moved without having to couple tractor-trailer air connections.

The auxiliary control installation consists of a dash hand control valve mounted on the trailer and connected.

When the emergency line is dis-

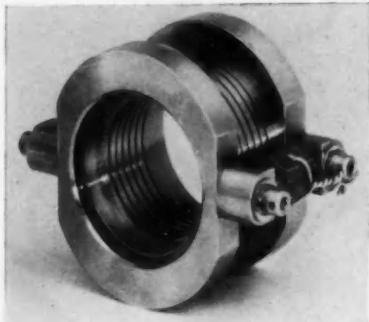
connected from the tractor, the trailer brakes can be released by pushing the dash valve handle in. Brakes are reapplied by pulling handle out. With the trailer emergency line connected to the tractor air supply, the dash valve handle automatically returns to, and remains in, the out position. It has no effect on normal brake operation. *Midland-Ross Corp., Owosso Div.*

Circle 57 on postcard for more data

Gas Line Bellows

A bellows for high temperature gas lines, particularly as required in airborne Auxiliary Power Unit systems has been developed.

These high temperature gas bellows



assemblies are used in pairs. The assemblies allow 0.11 in. for five-in. of angular offset movement to relieve the problem of expansion and contraction in the lines due to change in gas temperature.

The bellows sections are machined bellows, designed for operating pressure of 1400 psig with gas temperatures to 1200 deg F. *Hydrene Corp.*

Circle 60 on postcard for more data

Synthetic Oil

A synthetic oil has been designed for extreme low temperature applications such as chart drives, clock movements, meteorological and aircraft instruments.

Called Anderol L-423, this light viscosity diester oil features a pour point of below 105 deg F and a viscosity at 90 deg F of only 5,000 C's. These excellent properties combine with good oxidation stability and exceedingly low evaporation to produce a superior lubricant that meets the requirements of low starting and running torques over a temperature range of 100 to 250 deg F. *Lehigh Chemical Co.*

Circle 61 on postcard for more data

Two New Rubbers

New synthetic rubbers will be produced in volume at a new multi-million dollar plant in Texas. Known as Natsyn, made from isoprene, and Budene, made from butadiene, these man made rubbers are reported to have advantages over natural rubber.

Natsyn, according to the manufacturer, has a physical structure which duplicates the natural rubber molecule

and can be used both as an extender and a replacement for the natural product. It has exceptionally high flex and heat resistance.

The second new synthetic—Budene—is an extender for natural rubber and has many outstanding applications. Both rubbers will be used in tires, industrial products such as conveyor belts, and in other products requiring their properties. The new synthetics will outperform natural rubber in many applications, the company reported. *Goodyear Tire and Rubber Co.*

Circle 62 on postcard for more data

New Nutating System

The flick of a switch or the quick thumbing of a button is all it takes these days to adjust a landing gear or activate almost any piece of auxil-



iary equipment of a jet plane traveling at supersonic speed.

Achieving such precision, however, requires unerring performance by tiny motors made of material such as S-816, a cobalt-base alloy, which must hold its strength and stability even at temperatures of 1500 deg F.

Hydraulic actuation systems, common on the slower-moving aircraft, run into frequent trouble when friction temperatures pass the 500-degree mark and are therefore unsuitable for jet planes. Because of this, designers are turning to pneumatic systems. To meet the exacting demands of modern air travel and the even greater demand expected in the next generation of flight, project engineers at *The Marquardt Corp.* are developing a nutating disc air motor actuator system.

The nutating system gets its name from a pair of nutating—or nodding—disc motors which operate 180 degrees out of phase.

Reliable performance is assured by the absence of complex valving in the system. The movable element in the motor is a flat disc attached to a central sphere and mounted in a ring-shaped chamber which has a spherical sidewall bounded by conical upper and lower surfaces. The disc is prevented from rotating on its own axis so that when subjected to a different pressure a nutating motion is executed.

In this type of non-expansion positive displacement motor, output torque is a direct function of the volumetric displacement and differential pressure across the disc.

The nutating motor is noted for high performance and high efficiency throughout a wide range of inlet pressures, temperatures, speeds and loads. *Allegheny Ludlum Steel Corp.*

Circle 63 on postcard for more data

Hole Drilling Screw

An improved hole drilling-tapping screw has been designed to eliminate hole punching or drilling operations when a fastener is to be employed in joining light gage sheet metal.

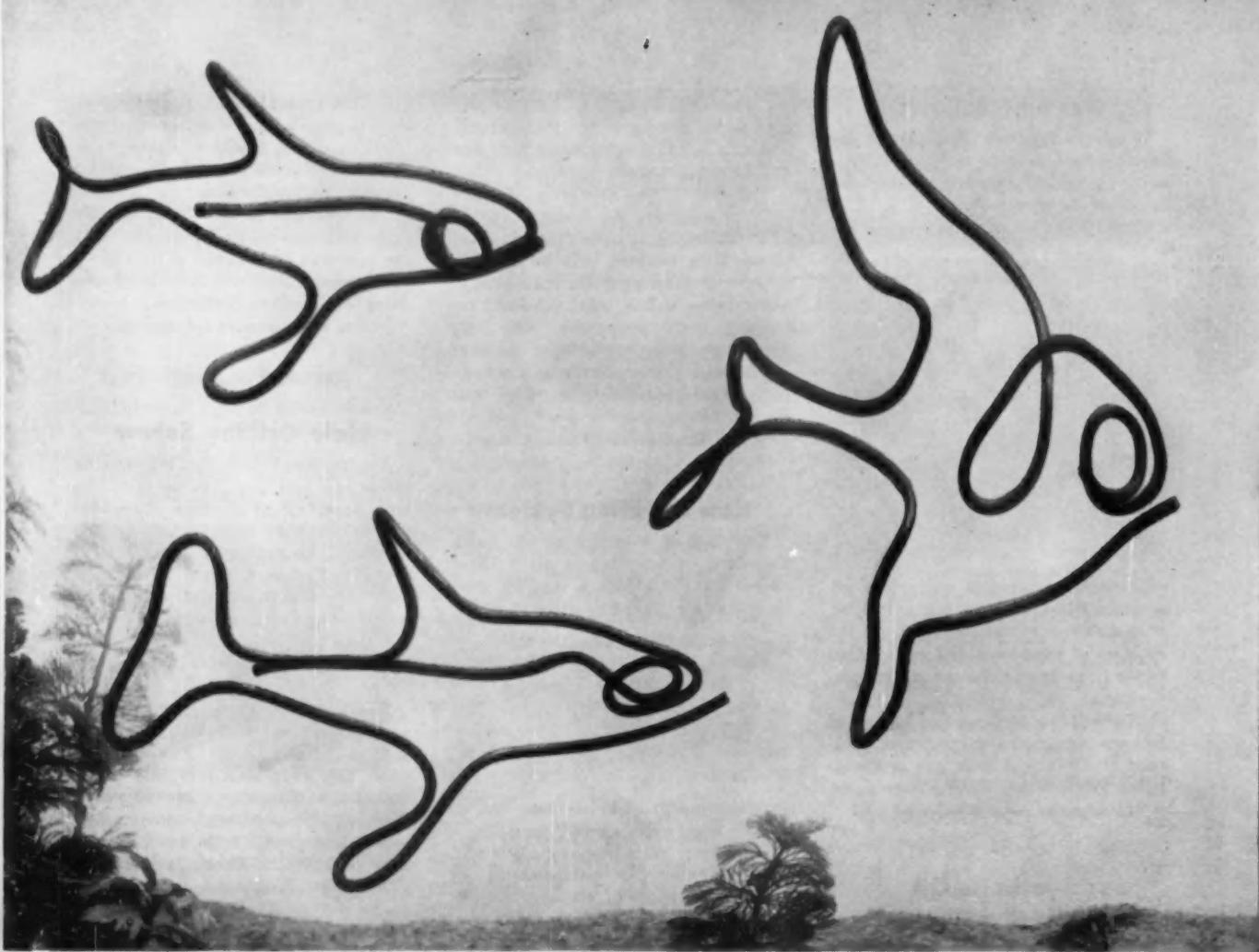
Called Tapits, this screw drills its own hole and forms its own thread, and has an integral washer with a serrated face that acts as a built-in brake to minimize stripping and spinning.

Tapits are designed to be used with a quarter-inch power screw driver with adjustable clutch. The manufacturer also supplies a magnetic driver socket that fits any standard power driver. Only one size socket is needed, since all sizes of Tapits, from number 6 to 10, have the same size hex head. Job tests indicate a saving up to

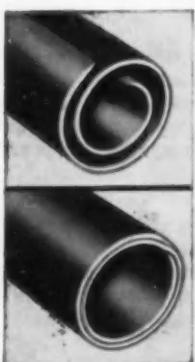


50 pct when these screws are used for assembling light gage metal parts. One operation—preparation of a hole by drilling or punching—is eliminated. Tapits have a cuniform (pyramid-type) point that starts drilling immediately . . . will not walk, skid or creep. Points are sharp, never rounded, truncated or cupped. They drive through light gage material with ease. *Parker-Kalon.*

Circle 64 on postcard for more data



There's almost no limit to the things Bundy can mass-fabricate



Bundyweld is the only tubing double-walled from a single copper-plated steel strip, metallurgically bonded through 360° of wall contact for amazing strength, versatility.

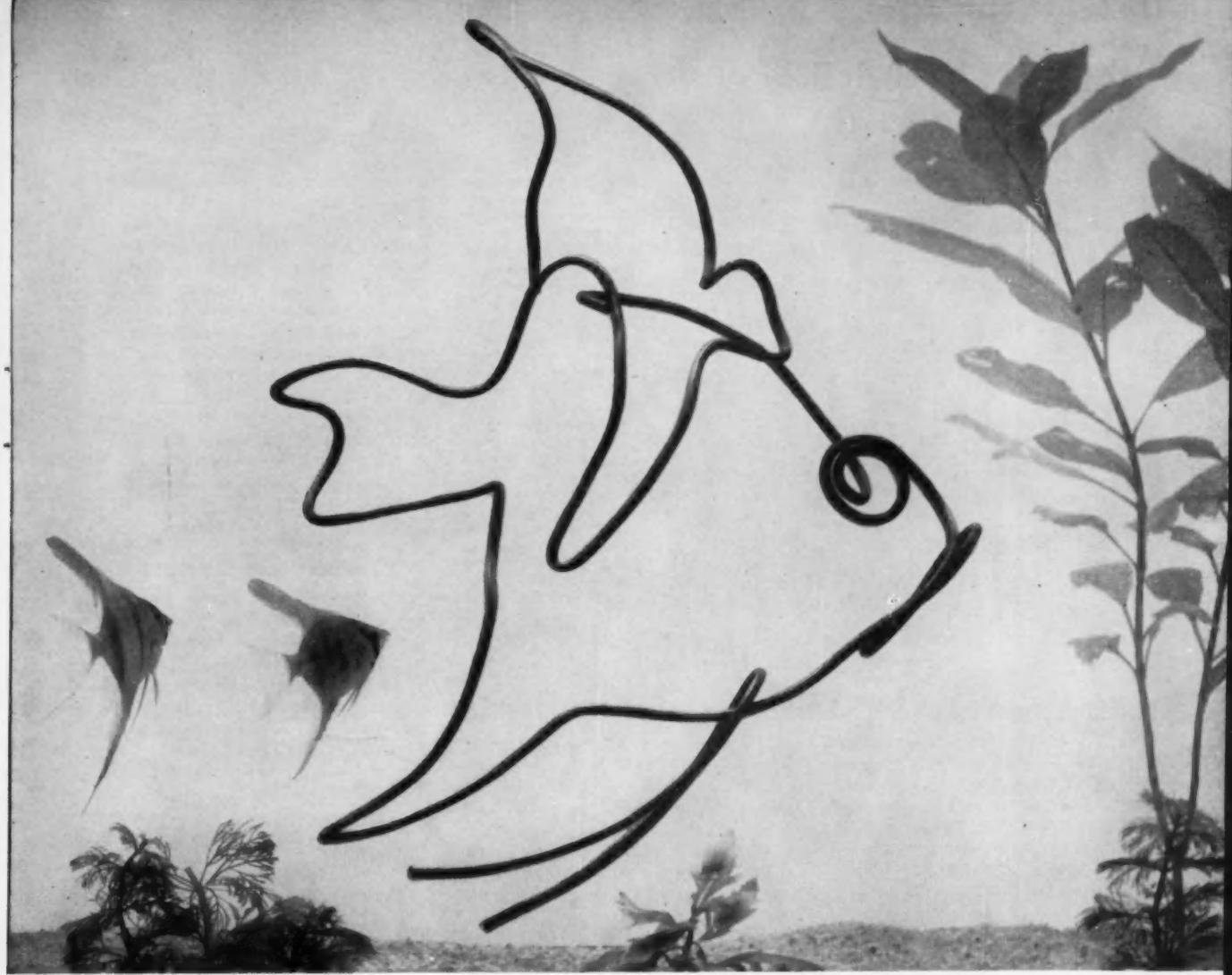
Bundyweld is light-weight, uniformly smooth, easily fabricated. It's remarkably resistant to vibration fatigue; has unusually high bursting strength. Sizes up to $\frac{5}{8}$ " O.D.

When it comes to mass-fabricating steel tubing into complex shapes, the folks at Bundy are specialists. Whether it's a push rod, a brake or fuel line—or a heat choke tube—chances are that Bundy can fabricate it better. Here are just a few reasons why:

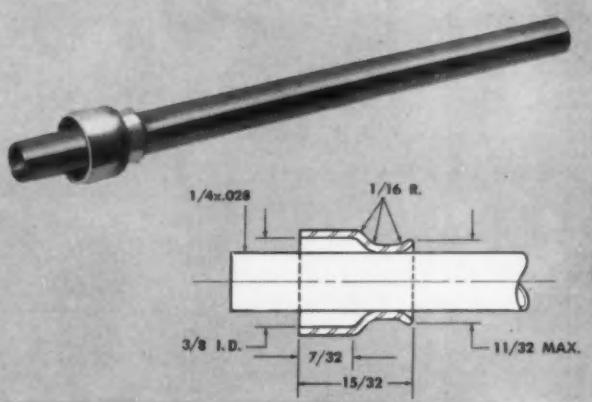
Bundyweld® Tubing is the original steel tubing *double-walled* from a single steel strip. Its high bursting strength and resistance to vibration have made it the safety standard of the automotive industry. Bundyweld is covered by Govt. Spec. MIL-T-3520, Type III.

Bundy designers will help you at any stage of product development. They may be able to suggest a new "twist" that'll cut your costs.

Bundy specialists will mass-fabricate parts to your specifications on Bundy-designed fixtures and machines. The unit-cost is low . . . the quality high. Got a tubing problem? Better see Bundy *first!* Phone, write or wire Bundy Tubing Company, Detroit 14, Michigan.



Bundyweld tubing is versatile, as demonstrated by this Bundyweld collar for an automatic heat choke tube. And Bundy is geared to give you mass-fabrication savings, too. Can Bundy solve a production bottleneck for you?

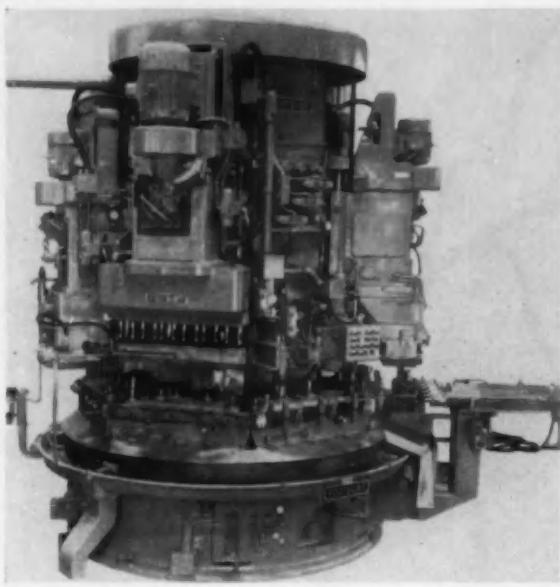


There's no real substitute for

BUNDYWELD® TUBING

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, BRAZIL, ENGLAND, FRANCE, GERMANY, AND ITALY

BUNDY TUBING COMPANY • DETROIT 14, MICH. • WINCHESTER, KY. • HOMETOWN, PA.



The fixtures of the machine are hydraulically operated. At the first station 3 rods and 3 caps are loaded and hydraulically clamped. The parts are then indexed to station 2, where a vertical head with 12 spindles drills two holes to half depth in each of the three rods, and two holes to half depth in each of the three caps. At station 3 (3 spindles) 2.500-in. diam cutters are used to mill an oil slinger groove in each cap. An extremely unusual construction is used by Foote-Burt to accomplish this milling operation. The Foote-Burt Co.

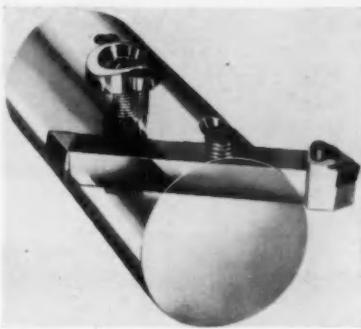
cross-slide to do internal and external turning, and a compound slide similar to that on the left spindle. This top slide, however, is suitable for operation as a fully automatic copying device. The independently adjustable feed rate remains constant in any copying direction. Proper working speeds are automatically obtained through an electro-hydraulic system, in accordance with program settings. Maximum turning dia is 9.1 in. Maximum swing is 9.5. The speed range of this unit is 14 to 1500 rpm, and feed ranges are 0.32 to 16 in. min. The Cosa Corp.

Circle 66 on postcard for more data

Throwaway Cutters

NEW cutters with standard throw-away carbide inserts have been designed for use in micrometer-adjustable fly-cutter tooling.

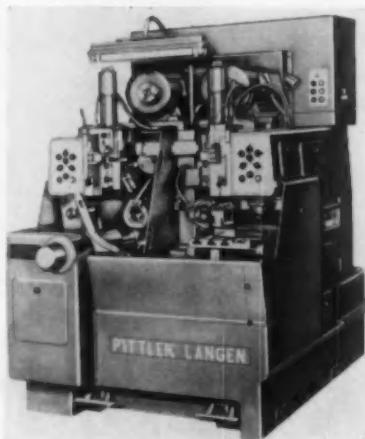
Micrometer-adjustable flycutter assemblies are available in stub boring tool sets, stub and line vars, multiplecutter boring heads, extension boring heads, and other types of tooling. The new throwaway insert cutters are



interchangeable with standard HSS or carbide cutters.

In the micrometer-adjustable assemblies, the cutter is adjustable in increments of 0.0001 in. by means of a direct-reading micrometer dial screw. Adjustment can be made without releasing setscrew pressure on the tool shank. This feature insures that the cutter holds position without backlash and resulting loss of accuracy. Davis Div., Giddings and Lewis Machine Tool Co.

Circle 67 on postcard for more data



Chucking Machine

A N automatic, two spindle chucking machine has been designed for economical internal and external front operation finishing of castings, forgings, gears, wheels, flanges and bevels. The spindles are independently driven by their own 13.5 hp motors, and have 8 working speeds each. The left hand spindle is provided with a turret slide having three index positions suitable for close-tolerance boring operations. A separate program-controlled compound slide does longitudinal and transverse cutting operations of any desired contour.

The right spindle has a heavy-duty

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Keeps You Informed

NEW

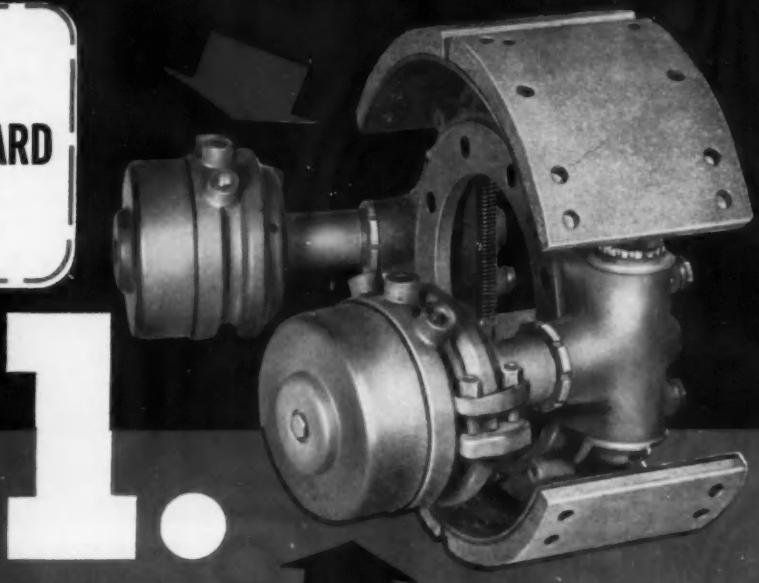
STOPMASTER BRAKE

OFFERS THESE 3 BIG EXTRAS!

**ANOTHER
ROCKWELL-STANDARD
FIRST!**

Proven the most advanced
brake design in 30 years . . .

Outstanding improvements, such
as a new balanced shoe actuation
principle and 15" diameter,
have made the Stopmaster
Brake the industry's most effi-
cient and dependable brake.
Now Rockwell-Standard also
offers you these three important
extras in the Stopmaster:



"Fail-Safe" Units . . . now available
for air actuated Stopmaster Brakes.

- Prevents runaway vehicles due to
loss of air, when in operation or
parked.
- Positive mechanical operation . . .
can be installed to operate from
dash control valve or automatically,
or both ways if desired.
- Lightweight and compact . . . no
installation problems, no cables or
special brackets required.
- Provides mechanical parking brake
. . . eliminates need for prop-shaft
brake.
- Brakes easily released . . . without
air pressure.

2 **Automatic Brake Adjustment** . . . available on
all Stopmaster Brake sizes for trucks, trailers, and
off-highway vehicles.

- Eliminates periodic manual adjustment.
- Cuts expensive maintenance costs.
- Brake maintains proper adjustment during
entire lining life.
- Safer operation at all times.

3 **Lubrication Eliminated.** All actuating parts
are sealed in lubricant. Standard on all
models.

- Prevents oil-soaked linings due to over
lubricating.
- Moving parts last longer.
- Reduces friction.
- Completely sealed unit reduces effect
of elements.

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CORPORATION



Brake Division, Ashtabula, Ohio

..... Trends in the CONSTRUCTION EQUIPMENT INDUSTRY

Minneapolis - Moline Co., Hopkins, Minn., has announced a new crawler tractor for the construction industry. Designated the MoTrac, the new vehicle has torque converter and instantaneous full-power reversing shuttle, 5-speed Moline-built transmission and 4-cylinder Moline-built Diesel or gasoline engine. The Diesel-powered model delivers 53 hp at 2000 rpm; the gasoline model produces 59 hp at the same number of revolutions.

Allis-Chalmers Mfg. Co., Milwaukee, has brought out a front-end wheel loader of increased speed and capacity, the TL-12, which will carry 4000 lb, and has a static lifting capacity of 9500 lb. Four speeds forward have a top speed of 21.2 mph, and four speeds in reverse have a top of 27.9 mph. By designing reverse speeds approximately 30 per cent higher than forward speeds in the same gear, the loader can back out at high speeds and without shifting gears after scooping up a load, so speeding the work cycle.

The loader is available with either an Allis-Chalmers 77 hp gasoline engine or a 76.5 hp Diesel engine. The transmission is coupled with a 13-in. single-stage torque converter having a 3 to 1 ratio. Four buckets are available, ranging from 1 to 2 cu yd capacities. The Diesel powered loader weighs about 11,550 lb as shipped.

Euclid Div. of General Motors is in full production of a new twin-power scraper of 14 cu yd struck capacity and 20 yd heaped S.A.E. rating at 1:1 slope. Designated as the Model TS-14, this all-wheel drive scraper is powered by two GM 4-71 engines, each with a separate Allison Torqmatic Drive consisting of torque converter and 4-speed semi-automatic transmission. With converter lock-up in each Torqmatic Drive maximum fuel economy is achieved with efficient use of the 296 total engine horsepower on grades and long high speed hauls. Air assist re-

mote control and full power shift enables operator to change from one speed range to another by a flick of the wrist to move the selector lever. No-Spin differential is standard in both drive axles. Tires are 24.00 x 25. Two hydraulic jacks provide full 90 deg steering. ■

By Kenneth Rose

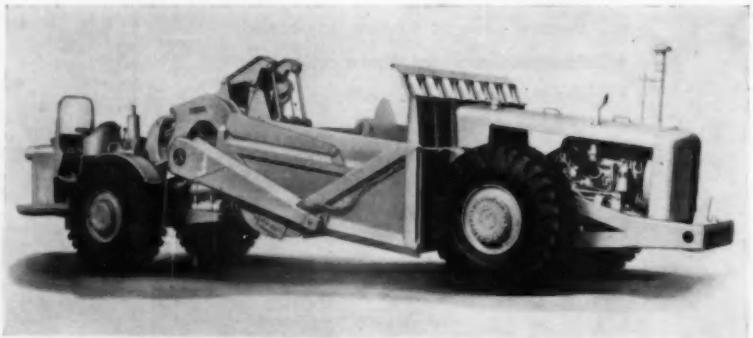
MID-WEST EDITOR



Minneapolis-Moline MoTrac crawler tractor



Allis-Chalmers TL-12 front-end wheel loader



The Model TS-14 all-wheel drive Euclid scraper



Manufacturers' News

Firestone to Spend \$120 Million

Five new plants are included in the \$120 million construction and modernization program of the Firestone Tire & Rubber Co. Included are tire manufacturing facilities now under construction in Calgary, Alberta, Canada, and Bethune, France. Synthetic rubber plants will be built in Port Jerome, France, and Bareilly, India, and a new plant will be completed this year in Orange, Tex., for the production of Coral and Diene, man-made rubbers. Firestone also is expanding its Hopewall, Va., factory for the manufacture of synthetic fibers and polypropylene. All North American tire plants will be expanded this year along with steel and plastics facilities. Foreign plants to be modernized are in England, Argentina, Brazil, and Venezuela.

Walker's Sales Parley

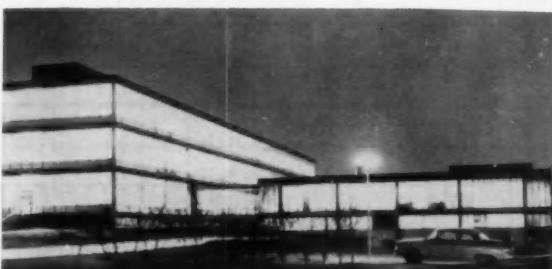
Substantial sales increases were hailed recently at a meeting of Walker Mfg. Co. sales engineers at the home office in Racine, Wis. J. W. Jaspersen, vice president and sales director, reviewed the sales program and declared Walker's recently created new products division has developed wide interest in Walker's automatic vehicle lubricator.

Crucible Steel's New Color Film

Crucible Steel Co. of America has shown its 45-minute color film, "Specialty Steels," to press, radio and TV editors and publishers of technical and business magazines. The movie tells the story of the science and art which goes into producing stainless steels and tough wear and shock resistant steels for the tool room. The film was made at Crucible's mill at Midland, Pa., while the making of tool steels is shown at the Sanderson-Halcomb Works, Syracuse, N. Y.

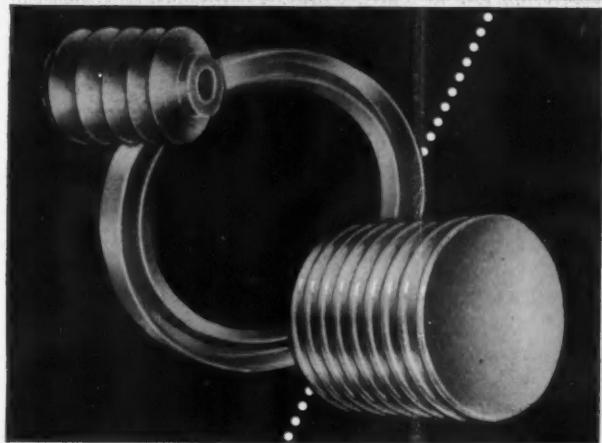
Motorola Schedules Expansion

Motorola, Inc., has announced plans to spend \$1 million for expansion of its Arcade, N. Y., factory. Work has begun on a 30,000 sq ft addition to the Arcade plant. Motorola recently announced plant additions in Franklin Park, Ill., and Phoenix, Ariz. Motorola is a main supplier for Ford, Chrysler, American Motors and International Harvester and is producing transmission actuators for Chrysler and American Motors.



Modern customer service facilities are housed in new Technical Service Laboratory of Union Carbide Chemicals Co. near Tarrytown, N. Y. The building houses 46 laboratory units as well as offices and supporting facilities.

for high and low temperature needs
SILICONE *
 Rubber Seals • Parts • Components



Come to Goshen when parts must function dependably under conditions that demand the skillful blending of properties like resistance to temperature extremes of -80°F to plus 500°F; resiliency over a range of -120°F to plus 600°F; low compression set; resistance to chemicals, acids, oxidation, ozone, moisture, corrosion, shock, abrasion; freedom from stain, odor, tackiness and toxicity.

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 CUSTOM
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Go Goshen RUBBER
 PARTS
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Write, Wire or Phone

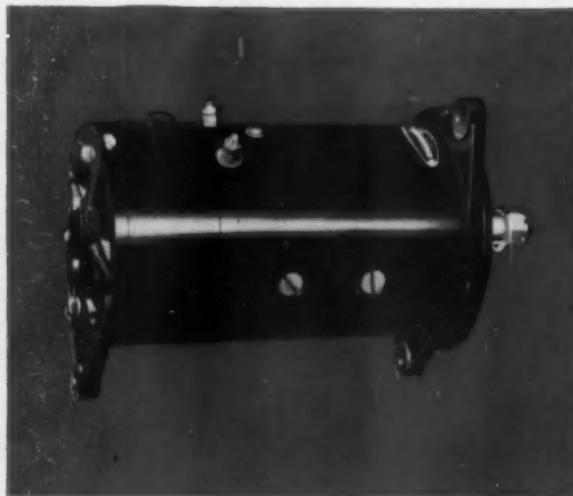
Goshen Rubber Co., Inc.

2760 S. TENTH ST.

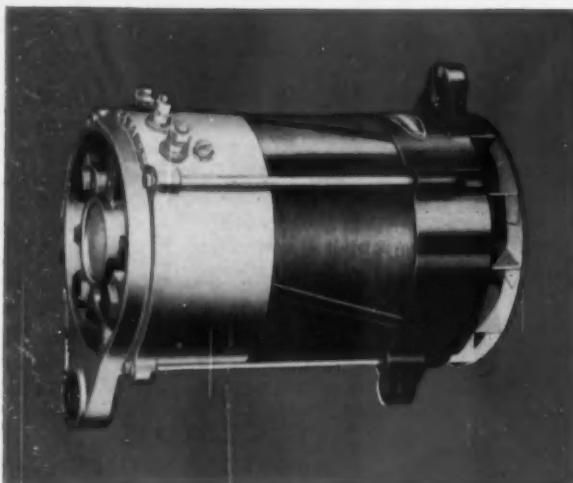
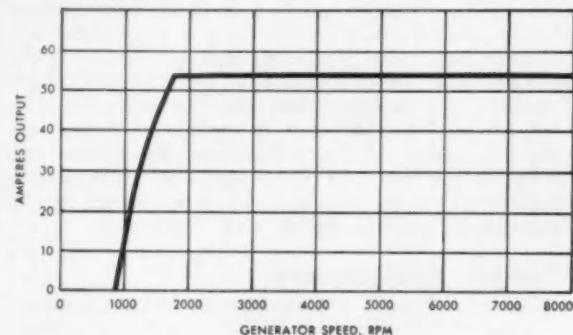
GOSHEN, INDIANA



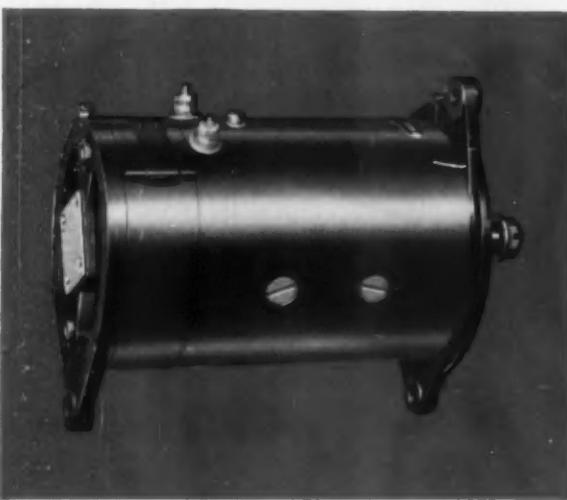
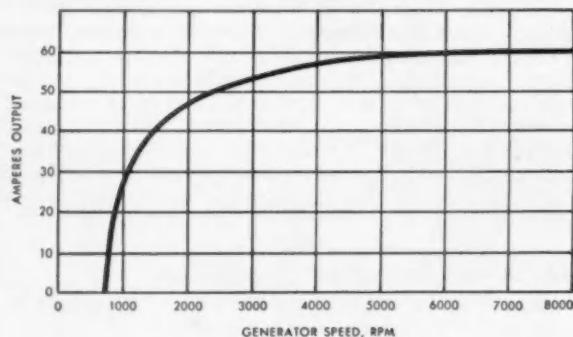
TAILOR YOUR TRUCKS



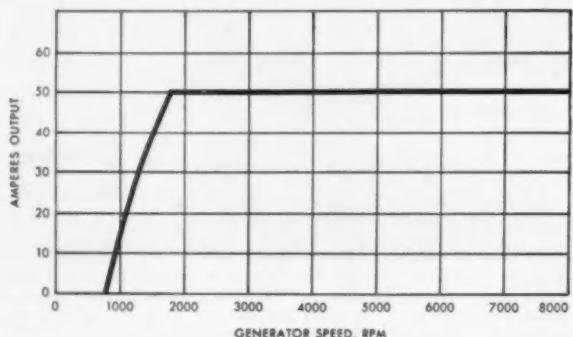
1106991 EXTRA-OUTPUT D.C. GENERATOR—12 volts
• 55 amperes • 12 amperes at idle—For cross-country trucks, school buses and other vehicles with extra electrical equipment.



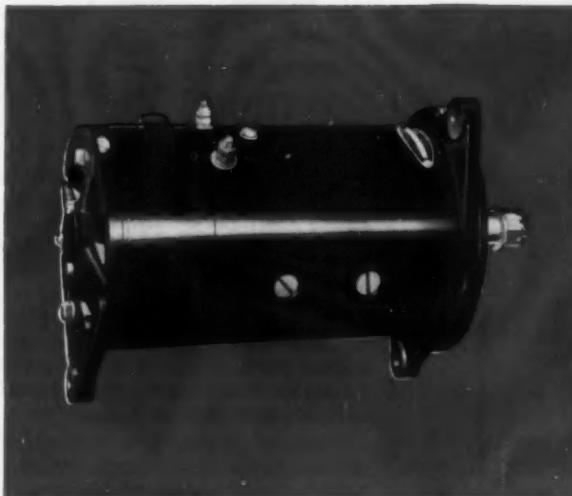
1117070 SELF-RECTIFYING A.C. GENERATOR—12 volts
• 60 amperes • 27 amperes at idle—For high-duty vehicles with heavy electrical loads . . . operating at all speed ranges. Ideal for excessive low-speed operation and curb-idling.



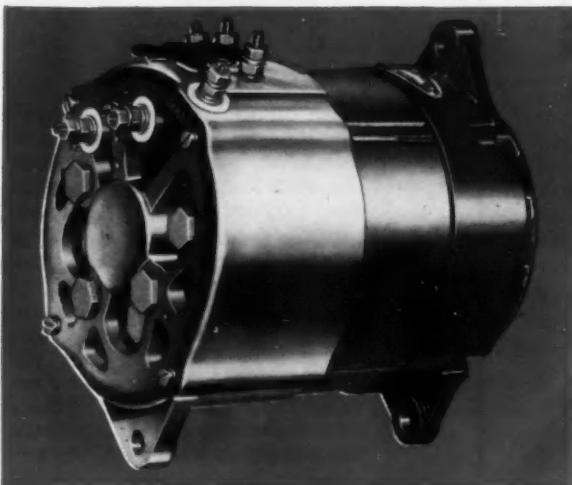
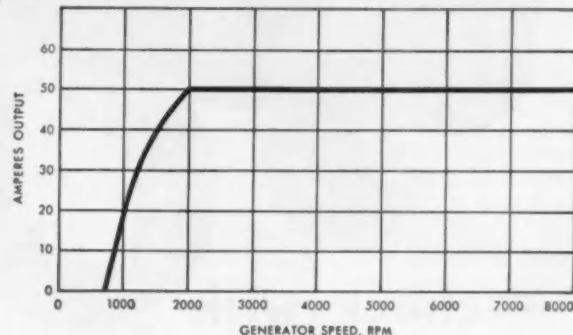
1106985 EXTRA-OUTPUT D.C. GENERATOR—12 volts
• 50 amperes • 14 amperes at idle—Short frame generator for difficult mounting applications. For vehicles in city and suburban use. Not for cross-country operation.



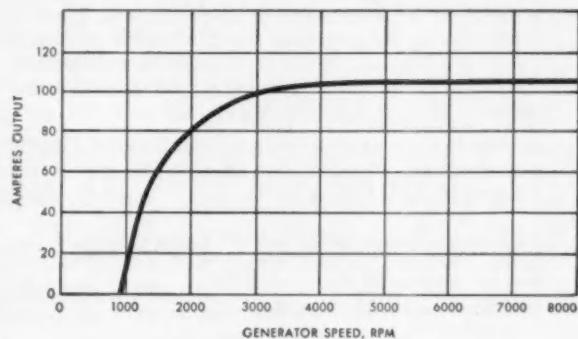
TO JOB CONDITIONS



1106986 EXTRA-OUTPUT D.C. GENERATOR—12 volts
• 50 amperes • 20 amperes at idle—For metropolitan trucks
and school buses, with extra electrical equipment . . .
operating at low speeds and with engine idling most of
the time.



1117115 SELF-RECTIFYING A.C. GENERATOR—12 volts
• 105 amperes • 10 amperes at idle—For high-duty
vehicles with extra-heavy electrical loads . . . operating at
all speeds. A.C. voltage available for 110 V conversion.



Delco-Remy offers a complete line of D.C. and A.C.-D.C. generators that are right for the job.

Demands on the electrical systems of trucks vary with their use. For best performance, whether the vehicles be new or already in service, the electrical equipment should be job-matched to meet those demands.

Do your trucks have extra electrical equipment? Operate cross-country, around town or off the road? Do they travel at sustained highway speeds, or with plenty of

stop and go? Whatever their assignment, there are Delco-Remy extra-output generators and regulators job-matched to meet the electric power needs *exactly*.

Delco-Remy ELECTRICAL SYSTEMS



FROM THE HIGHWAY TO THE STARS
DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

GEAR PROBLEMS?

—check with
FAIRFIELD!

GEAR PERFORMANCE to match the ever-increasing power and speed of modern machines is a Fairfield specialty. This is possible because Fairfield has long held a position of leadership in utilizing the most advanced methods, equipment, and techniques for producing better gears. By keeping apace with modern engineering trends, Fairfield renders an invaluable service to many of the nation's leading machinery builders.

If you have a gear problem, check with Fairfield. Our engineers are well-qualified to give you expert recommendations. CALL OR WRITE.

SPUR GEARS—Straight, helical, and internal. Sizes from 16 pitch, 1½" dia., to 1½ pitch, 36" dia.

HERRINGBONE—(Fellows Type). Sizes from 1½" to 15".

SPIRAL BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.

STRAIGHT BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.

HYPOID—Sizes from 1½" to 28" dia.

ZEROL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 21" dia.

WORMS AND WORM GEARS—Worms to 7" dia. Worm gears to 36" dia.

SPLINED SHAFTS—Lengths to 72".

DIFFERENTIALS—3,000 to 500,000 inch pounds capacity.

Note: All of the sizes above are approximate.

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Made to Order for:

TRACTORS • HEAVY DUTY TRUCKS • AGRICULTURAL MACHINERY • POWER SHOVELS AND CRANES
MINING MACHINES • ROAD GRADERS • BUSES • STREET SWEEPERS • INDUSTRIAL LIFT TRUCKS



Sen. Vance Hartke (D., Ind.) is pressing government officials to speed their investigation into imports of Russian autos in this country. He has demanded that the Treasury probe the price of Moskvitch cars the Russians plan to send here. He complains the import price is about \$1500, compared to \$2500 each at the tourist rate of exchange in Russia.

Defense contractors who hire retired military officers for the purpose of peddling influence would have their contracts cancelled or funds owed them by the government withheld if the Justice Dept. has its way. An anti-influence bill passed by the House last month requires the court-martial of an officer who takes a selling job with a defense contractor within two years after he retires. The officer also would lose retirement pay for two years.

When the summit talks collapsed, the Pentagon's reaction was "No increases in defense spending are needed." But Congress began to include higher figures in the military budget for the year starting July 1. The military men caught on and are now busily recommending expanding spending programs.

The Senate has passed a bill which could provide up to \$20 million in additional tax relief for U. S. companies with operations overseas. The bill would allow the firms to claim as tax credit either the "average" of taxes paid to several countries or choose the present system which permits tax credits on a "per country" basis.

Soviet buying of U. S. machinery is continuing at a high level despite the latest threats from the Kremlin. New government figures show the USSR bought \$35.4 million worth of U. S. equipment during the first three months of 1960. The Reds had sought approval to buy \$42.5 million worth of goods but the U. S. snipped \$7 million worth of military or strategic items from the list.

Engineering Advances in Automotive Fasteners

(Continued from page 63)

sented several major problems which the IFI technical people were unable to resolve or answer: How does a nut behave under a load? What is the role of dilation in a nut? To get answers to these and other questions the Industrial Fasteners Institute set up an aggressive fact-finding three-year basic engineering research project at the Case Institute of Technology, Cleveland, Ohio. This intensive and detailed investigation is known as Project 550. The project is headed up at Case by D. K. Wright, Jr., Professor of Machine Design; H. R. Nara, head of the Civil Engineering and Engineering Mechanics Department; and W. H. Tuppeny, Jr., graduate assistant.

The first phase of the project took this form:

1. A study and evaluation was made of all existing literature concerning bolt and nut interactions.

2. The photoelastic method was used to evaluate the distribution of stresses in loaded nuts through the use of epoxy resin nut and bolt models.

3. A large number of nut-stripping tests were made to evaluate nut testing procedures, and provide correlative data on steel nuts with which to check the photoelastic values.

The Literature Search

To begin IFI Project 550, the Case Institute researchers made a bibliographic study on nuts and bolts, with special emphasis on nuts, by studying some 800 publications. Of this number, 113 were reviewed more critically because they were thought to make some contribution to understanding nut behavior under load. As an indication of the thoroughness of this investigation, the literature search was made on nut and bolt material dating back to 1885. Only a few publications were studied in detail that were presented before 1940 unless the recurrence of reference

to these publications suggested that the work was a classic. One classic was the study of load distribution in screw threads presented by C. E. Stromeyer in 1918.

The results of this literature search were classified under five headings:

1. Load distribution in nut and bolt threads.

2. Bolt fracture. This covered the special case where nut strength was in excess of bolt strength.

3. Thread stripping. Here the nut was considered to have less strength than the bolt. While bolt threads can also strip, it can be altogether possible that this special case can be traced to deficiencies in nut geometry.

4. Nut height and nut material.

5. Miscellaneous. Although these topics were not included in this report as such, thread height, nut dilation, nut "bursting" forces, coarse-fine threads, and even thread lubrication were kept in mind during the literature search and in the design of the nut testing program that was to follow.

The Stress Analysis Study

The second stage of this project concerned the stress analysis study of threaded fasteners. This involved a three-dimensional photoelastic study. It provided a detailed picture of the nut stresses to guide the selection of boundary conditions for the analytical phase of the project.

For the first study, the $\frac{3}{8}$ -16-UNC thread was chosen as representing a commonly used, heavily loaded fastener size. Model nuts and threaded studs were made eight times full size of Hysol No. 6000-OP, a photoelastic epoxy material. Carbide-tipped lathe tools were used for cutting both nut and stud threads. Two studs, threaded at both ends, and four nut types were prepared, all made of the epoxy. The stud threads were cut to the minimum material limit of Class 2A, and the nut threads to the minimum material

limit of Class 2B, magnified eight times. This provided the loosest fit and the worst possible thread mating condition.

The four nuts were a circular cylindrical nut, 4.41 in. in OD; a standard finished hexagonal nut, 4.41 in. across flats; a thin-wall hexagonal nut, $3\frac{1}{2}$ in. across flats; and an approximate infinite nut, which was a rectangular plate 18 in. by 24 in. with the threaded hole at the center. All four nuts were $2\frac{5}{8}$ in. high. These shapes were chosen to determine the effects of corners and wall thicknesses on stress distribution.

The test procedure was very detailed. Stress patterns were frozen into two of the nuts simultaneously by loading them at opposite ends of a stud with a dead weight of 150 lb. Similar studies at loads of 50 and 100 lb on models of standard finished nut proportions with coarse and fine threads are still in process. The whole assembly was suspended in an oven. The loaded faces of the nuts were in direct bearing on steel plates. The models were then subjected to an annealing cycle consisting of heating at the rate of $3\frac{1}{2}$ F per hour to 270F, holding for 48 hours, and cooling at the same rate to room temperature. The entire cycle required about seven days.

After removal from the oven, the epoxy nuts were sliced into slices approximately $\frac{3}{16}$ in. thick. For each nut, the axial direction was taken as the z axis with the positive sense from the loaded to the unloaded face. From the outside surface of the nut radially inward was taken the positive x axis. The positive y axis was then taken circumferentially to make a right hand set of co-ordinates.

As part of the overall research project on nut behavior, the Case group was asked to make recommendations with respect to nut testing. A test apparatus was constructed on which a nut could be loaded to failure while records were taken of tension and torque in the bolt member, torque applied to the nut, and dilation of the nut. A large number of nuts were stripped under loading conditions extending from direct tension to torquing-to-failure. The sizes tested ranged from $\frac{3}{8}$ in. to $\frac{3}{4}$ in., coarse and fine thread. (Cont'd.)

Current Research Results

With the data received from the above research, the Case team has made two progress reports listing the following results:

1. The best test of ultimate load-carrying capacity of a nut is the straight stripping test on a hardened stud or bolt. The hardened bolt must be used to ensure failure in the nut, in spite of the fact that minor differences in nut stress distribution may be caused by the absence of plastic deformation.

tion in the bolt threads compared to loading on a soft bolt. Such a test is simple to perform and the results are highly reproducible. This consistency of results means that small sample sizes are adequate in setting up acceptable quality level standards. In contrast, a test which includes torquing of the nut requires additional complications of apparatus, attention to surface conditions, difficulty in maintenance of the bolt member, and yields close to the same results as the tension test.

2. The idea of using dilation as a measure of nut quality is an interesting one in view of the ease of obtaining positive data from a proof load type of test, but, it should be used cautiously in view of the high variability of dilation results. Another consideration is the fact that a mild dilation does not appear to reduce the load-carrying capacity of the nut. The Case Tech researchers felt that no specification should be written prohibiting all permanent set at the usual proof loads.

3. Readings permitting accurate evaluation of the relation between torque and tension in a threaded fastening have been taken. In the main, they confirm values commonly in use, but they also indicate the variations which may occur under different surface and lubrication conditions.

Immediate Objective

The immediate objective of the Case researchers is to create a mathematical model of a nut under load. In other words, they are working to find an equation or set of equations, checked by the experimental results obtained thus far, which will permit the calculation of the stress distribution for a given load and a given set of nut and bolt proportions and materials. To do this, the Case group is making use of the theories of elasticity and plasticity. In the end, the desired result should provide direction and information to enable the fastener designer and manufacturer, as well as the user, to specify the most efficient and economical nut for each major application.

Continuing Objectives

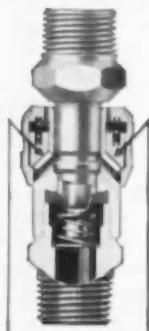
The technical problems of the 1960's will demand a continuing close working relationship on research, standardization, quality control and other problems between the fastener industry and its biggest customer, the automotive industry.

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the cost of fasteners themselves by working together in designing and developing the best engineered, the most efficient and the most economical fastener in place.

It is the in-place cost of the fastener that is significant and must be understood.

CONCLUSION

Work closely with your fastener manufacturer to get the most efficient and economical use of standard fasteners.

Work closely with your fastener manufacturer to get the lowest IN-PLACE cost of special fasteners. Aim to save dollars on the in-place cost, not pennies on the fastener itself.

The Institute's technical magazine *Fasteners* is published four times a year, and is distributed throughout the world to about 22,000 subscribers, each with a desire to keep up-to-date on fastener technology. Automotive engineers are regular contributors to *Fasteners*, and a glance through reader comments and correspondence indicates an exceptional interest in these automotive articles. This attests the fact that some of the most knowledgeable fastener engineers are associated with the automotive industry, and they are among the first to report technical advances and changing trends in fastener engineering.

Armored Vehicles in America's Future

(Continued from page 66)

is required. Some means of solving the conflicting problem of heavy armor and light-weight must be found. It may be that light-weight vehicles could be transported to the theater of operations and then, on the spot, provided with some type of armor protection adequate for the mission. Such a system, again, will require further developments of new and special purpose materials. Another approach would be to operate tanks remotely, thus eliminating much of the armor protection required for a crew.

UNCONVENTIONAL PROTECTION

In addition to developments in the field of vehicular armor protection, unconventional protective measures may, at times, be required. The armor of the future, if provided with proper devices, could dig itself in. This concept, of course, is similar to the present practice of a foot soldier protect-

ing himself with a foxhole when not on the move. The foxhole, depending on its construction, of course, can provide excellent protection. Several approaches to the foxhole principle for armor can be explored. Any one of these may be the approach used in the future.

The first and simplest from the additional mechanism standpoint would be simply to blast a hole in the ground with a high explosive charge. The hole should be suffi-

cient to completely conceal the vehicle. This method, of course, provides a depression in the ground which will protect the vehicle from all but overhead attack. Since the dirt moved by the blast has been scattered over the surrounding area, there would be no easy means of pulling it back into the hole to completely cover the vehicle. A completely covered vehicle, of course, would not only receive the protection the ground affords, but

(Turn to page 110, please)



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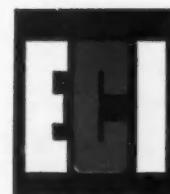
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quick facts
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Weld Nuts or Weld Screws, and you want to be sure they're designed right and made right . . . that's where we come in. We know Welding Fasteners, and we stock many of the most commonly used.*

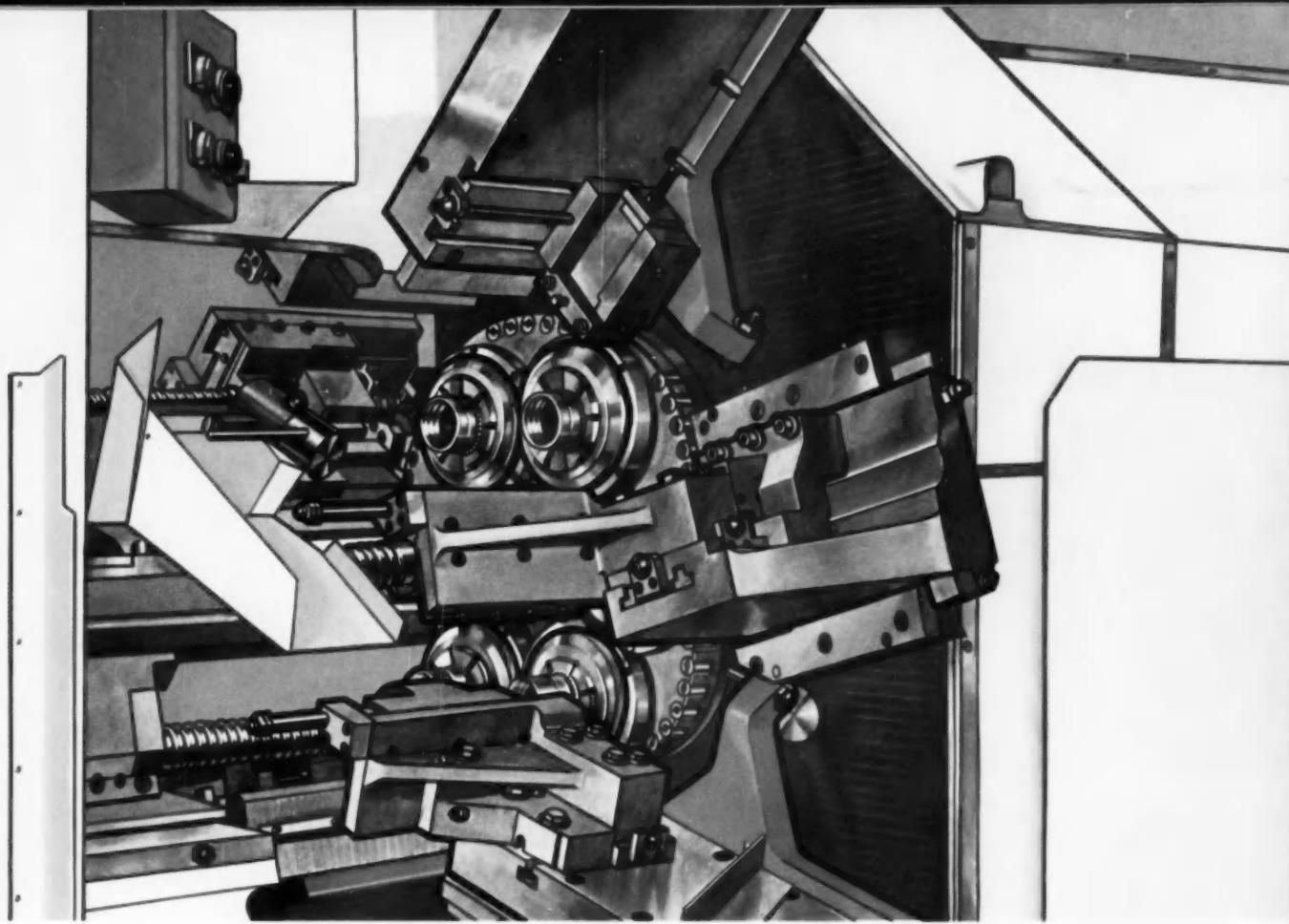
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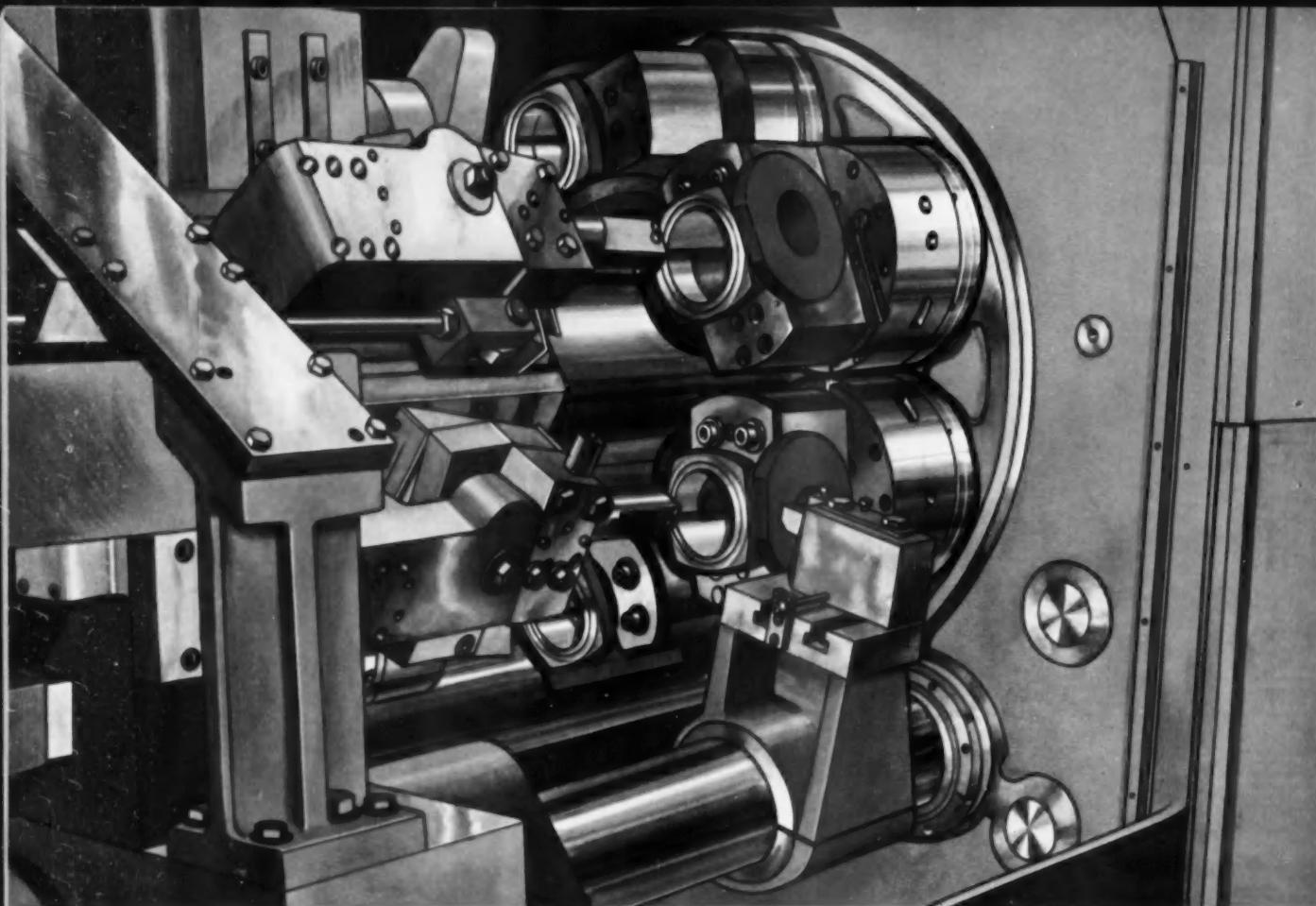
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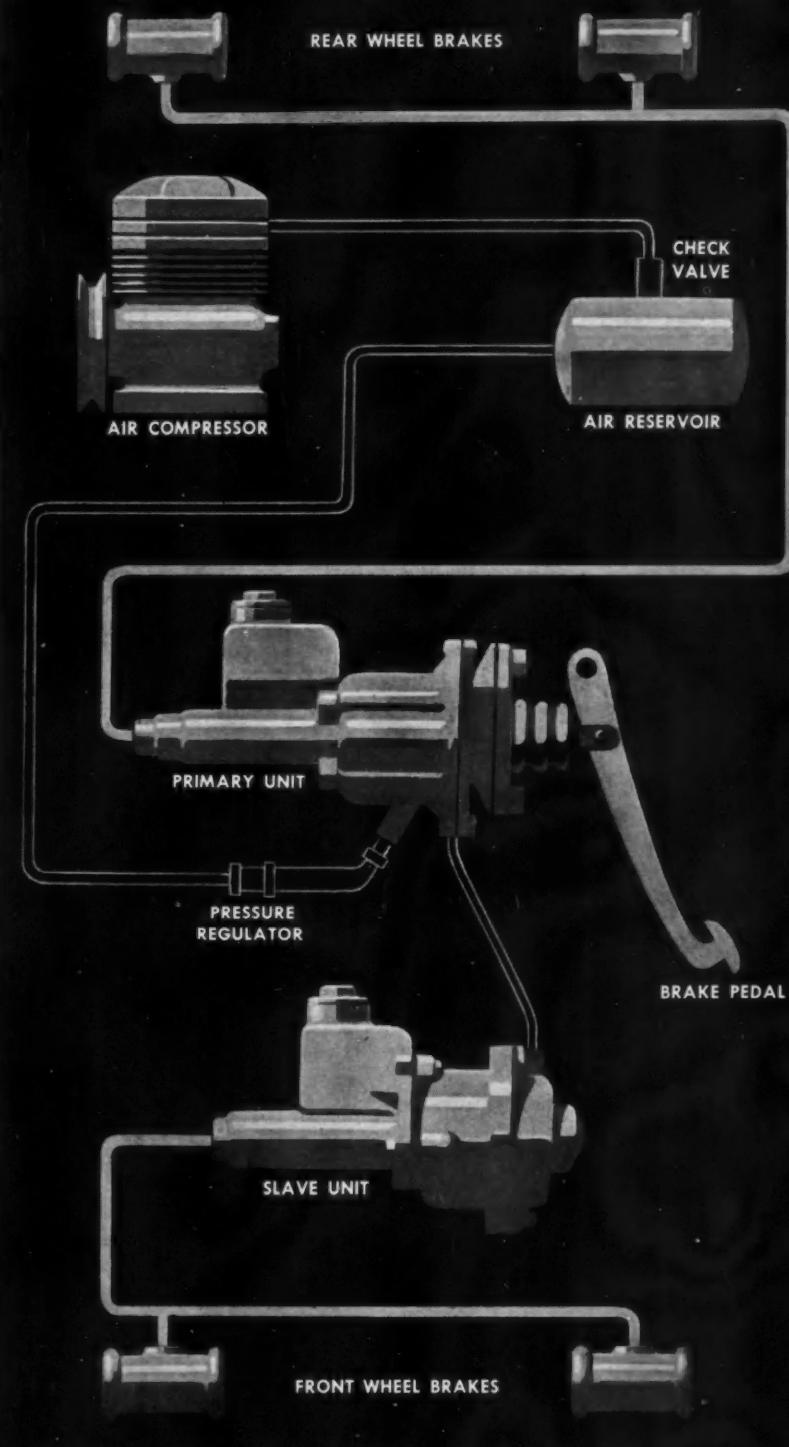
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Armored Vehicles in America's Future

(Continued from page 103)

would be a great deal more difficult to detect.

Another approach to this problem would be to follow the principle currently used in the mining industry. In this industry machinery has been developed which is capable of automatically mining a vein of coal. It is conceivable that some of these designs could be applied to armor to permit it to dig in and completely cover itself while in the ground. The difficulty at present seen in this type of mechanism, however, is its size and bulk which would be in addition to the already critical vehicle weight.

A third approach would be to develop vehicles employing a multiplicity of tracks completely across the underside of the vehicle. When the desire is to dig in rather than to move forward, alternate tracks would be driven in reverse direction. The track design could be such as to rapidly dig the ground away under the vehicle, lowering it into the resulting pit. This concept, while presently appearing to be the most practical for armor use from a digging-in standpoint, still has a number of problems inherent in its application. The first drawback is that no means of developing a completely "bellyless" vehicle has been found. It is always necessary to have a portion of the undersection of the vehicle employed to get the power drive down to the tracks and also to provide the supporting structure between the suspension system and the rest of the vehicle. The completely "bellyless" vehicle would also provide superior mobility when crossing particularly adverse terrain. If the other problems can be overcome, the center tracks can be raised off the ground for crossing harder terrain. It would only come into play during the digging-in actions or in the areas where the narrower outer tracks sink into the ground. Any of these devices, when providing the digging-in capability, should employ the vehicle power plant rather than requiring auxiliary power systems.

Another approach consists of

mounting expandable pockets on vehicles which would be filled with dirt and rock found at the place of action. Such a vehicle would be extremely light in its transportation phase where it would have little armor protection and the various pockets collapsed. On arrival in a zone of action, it is envisioned it would then have its pockets extended and filled with the material available in the area. This concept has its attractive side but does not appear to provide realistically the armor protection that is so vitally needed. Over 20 feet of average earth are required to be the equivalent of the armor protection needed to stop a 90mm armor-piercing projectile. Pockets containing this earth would be rather impractical in that they would almost assuredly immobilize the vehicle from a size standpoint alone. If a foaming material, such as currently available in the plastics field, could be developed which would provide the necessary protection while maintaining the foaming characteristics now inherent, it would be a particular boon to armor of the future. It is quite conceivable that the radiation shielding effect can be obtained even if the projectile protection does not come up to the level desired.

SUSPENSION SYSTEMS

The components for the suspension system of future armor must undergo a tremendous change. We have been traveling on wheels and tracks for centuries. While these systems have served us well in the past, it appears now that we must look for new approaches to improve terrain crossing agility. The latest requirements indicate a system that will provide very rapid transit over all types of terrain while at the same time being economical of fuel consumption and component life. Various types of airborne vehicles appear to have promise in this field. It should be specifically noted, however, that future armor should not be considered in the truly airborne category. Armor should be developed

as ground vehicles that have the capability, not of flying relatively high above the earth, but simply skimming over the ground. The possibility also exists of developing jumping and/or walking vehicles which could provide superior cross-country agility. Speed, in general, can be relegated to man's inventiveness but man has yet to create a mobile unit that can even approach the agility of most land animals.

PROPULSION SYSTEMS

Any of the above suspension systems will require propulsion systems having greatly increased efficiency. The rapid movement over great distances makes it mandatory that power plants be capable of operating for long periods of time without refueling. Furthermore, the maintenance of both the

propulsion and suspension systems must be such as to provide several thousand miles of operation without any repairs whatsoever. A vehicle is envisioned, in fact, for the near future which will be able to operate for several thousand miles, not only without maintenance but without requiring refueling. This, of course, could be done presently with atomic propulsion. Here, however, the problem of weight caused by the tremendous shielding required makes this type of equipment unsuitable, for armor, unless the vehicles were to be operated by remote control. ■

This is Part I of a two-part article by Raymond J. Astor, Major, Ordnance Corps, US Army. The second, and final part, will appear in an early issue of AUTOMOTIVE INDUSTRIES

Building Industrial Engines at Caterpillar Plant

(Continued from page 78)

V-8 and V-12 units, which are built here complete, is that all of these in the same size range have similar assembly characteristics, using the same torque wrenches and so on.

The engines are built in 4-in., 4½-in., 5⅛-in., 5¾-in. and 6¼-in. bores. They are available for use of Diesel fuel. In addition, the 5¾-in. bores are also available for use of natural gas. They are designed for use of turbocharging and some models for aftercooling also. Some are naturally aspirated. There is a choice of compression ratios in natural gas engines and gear reduction ratios for marine and industrial versions.

Engines from Peoria are assembled without flywheel and with or without gas starting engines, and are tested there before shipment by truck to Mossville. The engines are mounted on supporting frames which key into channels recessed into the floor of each delivery truck, permitting the engines to be rapidly loaded onto the trucks without elaborate hold-down rigging. They are transported more than 10 miles to the Industrial Engine Division plant, are lifted from the truck to a storage area and then are taken to the assembly line.

All engines at the Mossville plant are built on moving assembly lines. The line for the engines "bought" from Peoria is 7 ft wide and the big engine line only 2 ft narrower. Both are steel plate-type conveyors flush with the floor. Assemblers can walk about the engines or ride the conveyors. Parts and subassemblies are stored in bins along both sides of the conveyors. Pneumatic and electric torque wrenches, and like assembly tools, are suspended overhead so that they can be pulled down to working position as needed.

For all engines, the attachment groups are on the engine order sheet that accompanies each engine on the assembly line. Some of the major subassemblies are generators, heat exchangers, radiators, marine gears, torque converters, power take-offs, governors, oil coolers, fan subassemblies, water cooled manifolds and surge tanks.

As all engines except the V-models are received as complete basic units in running order, it is a matter as important as adding the correct parts to subtract all unwanted parts. All cancelled equipment is removed from the assembly line to storage space along the lines, is there accumulated to good

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quality, identified, cleaned and returned to production inventory.

For removal of the oil pan, a special trunion fixture has been designed and built by Caterpillar engineers to facilitate easy tilting of the engine to make the oil pan accessible while holding the engine securely. It consists of a steel table, with a vertical steel back-up plate behind it. Oil is first drained from the engine into one of two recessed pits, one for heavy oil, the other for light. The engine is then

lifted onto the table of the trunion fixture. Studs are then screwed into a steel plate mounted on the vertical plate and attached to the lifting bracket. Pressing a button on the control panel starts the hydraulic actuation so that the vertical plate tilts backward carrying the engine to a horizontal position in which the oil pan is easily accessible. The engine is held by the two rear support pads resting on steel blocks and by the top studs. Because studs and blocks are ad-

justable, any of these tilting devices can handle any engine in the line.

Another device installed on the assembly floors is the transfer car, to carry engines or equipment from one bay to the next, and therefore from the range of one travelling overhead crane to the next. These cars, flat bed and of steel sheet, run on recessed tracks, each track just long enough to carry the engines to the next bay—about 15 ft. They are electrically driven, remote controlled transfer cars. One man can move engines from one crane reach to the next.

The V-8 and V-12 engines from the assembly line go to the dynamometer test room, where the engine is run on the dynamometer and tested for fuel consumption, horsepower, engine speed, etc. After tests have been completed, the engine goes back to the jobbing floor for addition of any attachments back of the flywheel or ahead of the fan, and again goes to the test floors for tests with these attachments. Engines from the East Peoria plant are also tested after attachments are added. The engine then goes to the sheet metal and final checkout area where the hoods, dashes, sidedoors and similar parts are added. Moving on to the paint booth, the engine is painted by the hot spray method in which the prime coat and then the finish coat are sprayed hot, without dilution, onto the machine. The completed engine is then trimmed and readied for shipment and moves out to the shipping area.

The docks at the shipping area can accommodate six tractors and trailers, all inside the roll doors. A large scale weighing platform 24 by 10 ft, so designed that it will weigh accurately at either end, is located so that it extends under the travel of the overhead cranes in two bays. All shipments pass over this scale before loading. Shipment is made from here to Caterpillar Dealers or customers, or to terminals for other means of transportation.

Because the new plant was planned to fit into Caterpillar's overall production scheme, certain operations adequately provided for elsewhere in the company were omitted here. No heat treating is done at the new plant, no gear cut-

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ting or splining, and no machining of crankshafts, camshafts, cylinder liners or heads.

Castings for both the V-8 and V-12 engine blocks are machined on the same production line. First operation is the rough and finish milling of the pan rails and bearing locks, done on an Ingersoll mill with four cutters. The head face and three surfaces on each side of the block are rough and finish milled in the next operation, done on a Newton mill with 8 cutters. Sides of the bearings are milled on a special Ingersoll bearing face mill. Another Newton milling machine then rough and finish mills both ends of the block, and mills the top and sides of the ledge on the rear end. The vee and the pads at the bottom of the vee are next milled on a Cincinnati milling machine.

As all V-engine blocks are machined on this line, the W. F. & John Barnes boring mill for machining the cylinder bores is built with four spindles, in two pairs, the center-to-center distance of

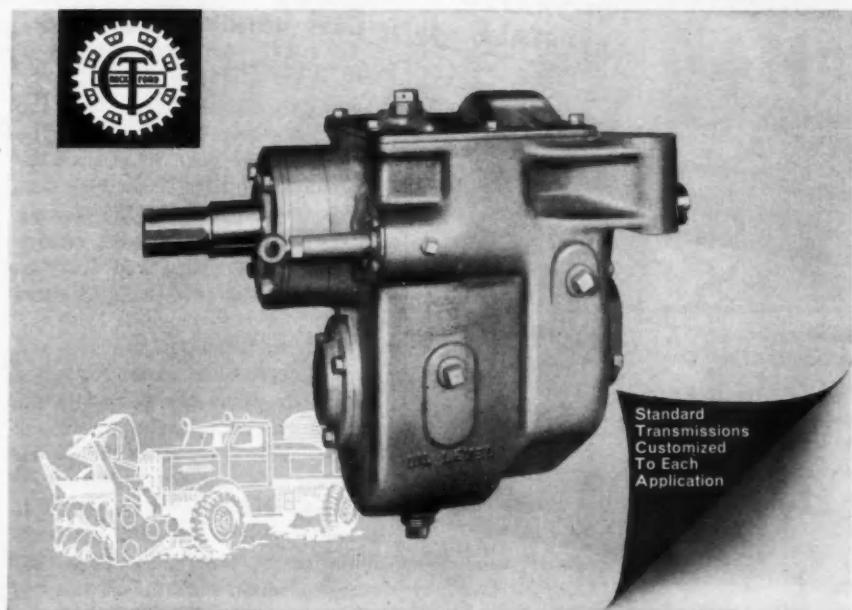
which corresponds with the center-to-center distance set up as standard for the cylinders of all engines of these series. The block is placed in the boring machine, in normal operating position, and the boring bars are positioned and fed on a 30-deg angle. The cylinder liner bores are then rough and finish bored, two at a time, counterbored at the top and chamfered at the bottom.

On a W. F. & John Barnes drilling machine, with twin columns inclined to the angle of the cylinders, drilling heads on each column carry multiple spindles to drill and counterdrill 32 stud holes in each head joint face, and a horizontal drilling head drills 32 holes in each side for inspection covers, and 24 holes in each side for water passage covers. This is for the V-8 engine block. A multiple-spindle Natco drilling machine then takes over and in two passes drills 67 holes on the pan rails and bearing locks for the V-8 block. A Cincinnati-Bickford radial drill and a Carlton radial drill then drill, ream or tap holes for cylinder head studs,

water passage cover studs, dowel holes and other miscellaneous holes with the help of about 20 fixtures and drill plates, each removed or repositioned after the operations it controls are completed.

After these operations, the block is washed and cleaned. Bearing caps are then assembled and marked. The cam-bore boss on the rear end of the block is next faced and chamfered, and main and cam-shaft bearings are rough and semi-finish bored and then finish bored. Holes in the pad between vees are drilled and reamed, and front and rear dowel holes and balance shaft holes are bored. After miscellaneous holes are drilled in sides and rear end, the head studs are placed, and cylinder liners and covers are assembled and liners are stamped to indicate the center line of the cylinders. The block is then given a water test. After the test the liners are lubricated and inserted, remaining bolts, covers, gaskets, plugs and flanges are assembled, the block is washed and cleaned and moves to the assembly line. ■

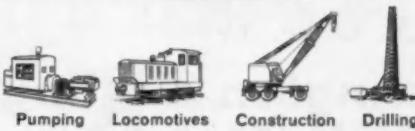
Add "creep" control with Cotta auxiliary transmissions!



COTTA
HEAVY-DUTY TRANSMISSIONS

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS

AUTOMOTIVE INDUSTRIES, June 15, 1960



Need "creeping" speed for special truck, crane, or materials-handling operations? Cotta's heavy-duty auxiliary transmissions add slow-speed control to special jobs by further reducing engine speeds carried through standard transmissions.

Snowplows, for example, use 9:1 ratio of Cotta's TS auxiliary transmission for full power while crawling through heavy snow — shift to 1:1 ratio for over-the-road runs. Model TS employs amidship mounting and uses mechanical or power shift.

Cotta auxiliary transmissions with two speeds forward, or forward and reverse, can be custom-designed with individual chassis mountings for a wide variety of special heavy-duty operations. See our catalog in *Sweet's Product Design File*. Then call Cotta (TWX-RK-7720 or phone WO 4-5671) for details.

Circle 158 on Inquiry Card for more data

You Are Sure of Trouble Free Compressed Air...with an Adams Aftercooler and Cyclone Separator



Are you really operating your compressed air equipment with clean, dry air... or with air laden with oil and water and other trouble causing impurities? Tool malfunction, production down time, off grade work almost always can be traced to dirty, contaminated air. Compressors are designed only to bring ambient air to operating pressure. This air is saturated with moisture and oil vapor which must be removed to guarantee maximum production efficiency.

An Adams Aftercooler with its exclusive Cyclone Separator, is specifically designed to remove unwanted water and oil from your compressed air. A standard Adams unit cools the compressed air to within 10° of the cooling water temperature for the condensation of oil and water vapor. The Adams scientifically designed Cyclone

Separator then removes this condensed "trouble source" over the entire range of operating capacity. Thus, only clean, dry air is provided to your compressed air system. Production cycles are extended, maintenance costs reduced, down time eliminated.

Why not investigate the advantages of an R. P. Adams Aftercooler and Cyclone Separator in your compressed air system. Write today for your copy of Bulletin 714.

R. P. ADAMS CO., INC.

264 East Park Drive, Buffalo 17, New York

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MACHINERY NEWS

(Continued from page 82)

employ punched tape read by a photocell type reader.

E. W. Bliss Co.—has purchased a 26,000-sq-ft office building at 520 S. Ellsworth Ave., Salem, O., as new headquarters for the company's Rolling Mill Div.

Lapointe Machine Tool Co.—Frank J. Kenney has been appointed sales manager.

Baker Brothers, Inc.—has appointed the D. E. Miller Co. as sales representative in Michigan. Don Miller, head of D. E. Miller Co., was formerly manager of Chrysler Corporation's Mound Rose Engine Plant. The Miller firm also represents Colonial Broach & Machine Co. in that area.

Hershey Metal Products—William R. Knowles, formerly sales manager of The New Britain Machine Co.'s Precision Products Div., has joined Hershey as sales manager.

Douglas Tool Co.—John P. Vederko has been appointed vice-president and general manager. ■

East German Gear Line

(Continued from page 73)

clamped hydraulically so that the outer jaws grip the blank and the inner ones the gear. This transfer assembly then lifts slightly so that the gear flange clears the seating recess in the work spindle, swings through 180 degrees, and drops to lower the blank onto the work spindle.

When hydraulic pressure is cut off the arms are expanded by a spring, dropping the gear onto the exit chute and releasing the blank in the hobber. The machine cycle reverses as the workpiece is clamped and the hobbing slide travels in for the cut. The outgoing gear trips a switch that starts a chain elevator at the end of this exit track.

Here the gear is engaged by a pawl on the chain which carries it up to an inclined overhead chute leading to the magazine feeding the deburrer. Cycling of the right-hand hobber is the same, and its

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...for all requirements, industrial and decorative

...facilities for perforating most metallic and non-metallic materials

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5630 Fillmore Street, Chicago 44 106 Liberty Street, New York

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output converges on the common overhead track.

Gears are retained at the bottom of this magazine by an escapement mechanism actuated at the appropriate point in the complex sequence of movements of the load/unload arm serving the deburrer. This is a standard machine with opposed twin spindles on an indexing table, and is designed for grinding tooth edges on both sides.

The arm is thus required to turn the gear over between loading and unloading operations. It terminates in a hand in the form of a double "U," the gear entering and leaving through one edge, and the open center section exposing its bore to the idle work spindle.

This handling unit is pneumatically operated, with electro-pneumatic limit switches controlling its cycle of three basic movements: thrust (to move the gear between gravity track and spindle); transverse (to lower it on or lift it off the spindle); and rotary (for turnover and tilting the gear into the exit track).

When a gear is released from the magazine it rolls down the track into the hand whose inclined air ram then thrusts it forward, after which the slide supporting this cylinder moves down to place the gear on the spindle, and the hand retracts while in this lower position. At the same time, on the opposite side of the rotary table the grinding head with spiral-profiled wheel retracts from the work, and the table indexes clockwise 180 deg.

As this occurs the drive from the work spindle is disengaged, and the entire spindle assembly is slowly rotated during the table travel by an outer ring that rides along a semi-circular track around that half of the table.

This is to align an arresting pin, parallel to the spindle, that engages the lower flanks of one pair of teeth to locate the gear radially during grinding. During loading and unloading the pin must be directly above the spindle to clear the U-shaped mechanical hand, and when it has reached this vertical position an internal pawl locks the spindle assembly to prevent further rotation.

After table indexing the wheel-head feeds into the new workpiece,

while the air-operated hand, still lowered on its slide, advances over the semi-finished gear to lift it off the idle spindle. A rack and pinion mechanism now rotates the arm 180 deg, and the hand then drops the inverted gear back onto the spindle and withdraws.

Following the next indexing the finished gear is removed from the spindle in the same way, and the hand retracts and swivels 15 degrees to tilt the gear into the exit track, where it trips a switch that

restarts the cycle.

Gears leaving the deburrer roll down to the lower end of the automatic washing machine. This consists of an inclined chain elevator enclosed in a square-section housing divided internally into four separate compartments — two for hot chemical wash, and one each for rinsing and air drying.

Elevator movement is not continuous, but in upward steps regulated by a timer that actuates the

(Turn to page 118, please)

Rockford Clutches For Dependable Performance

Specifically designed to meet the requirements of your projects. Rockford Clutches are longer lasting, require less maintenance and have proven performance. Write for complete information.



ROCKFORD CLUTCHES

ROCKFORD CLUTCH DIVISION



BORG-WARNER

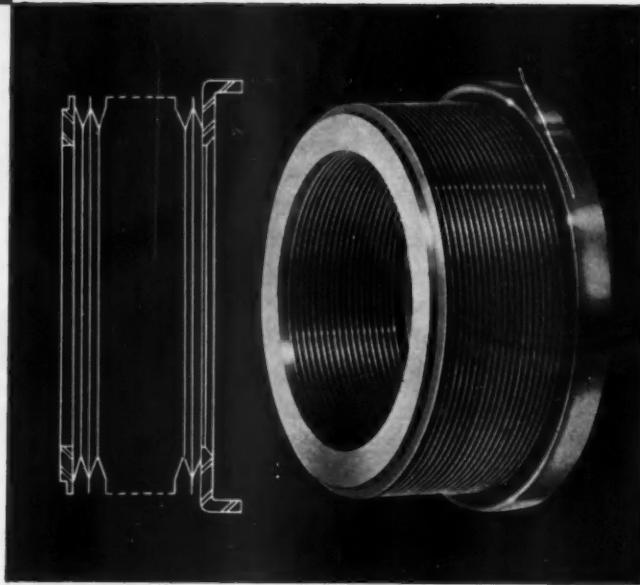
315 CATHERINE STREET

ROCKFORD, ILLINOIS

Export Sales Borg-Warner International—36 So. Wabash, Chicago 3, Ill.



How C/R's New Metal Bellows Seal Meets Seemingly Impossible Operating Conditions



Operating Ranges

Temperature -400° to 1000° F.
Pressure 500 psi
R.P.M. 80,000 plus

These known operating ranges indicate the function of this seal. It is designed for applications where temperatures and mediums to be sealed forbid the use of any organic materials. Typically, these applications include fuel pumps, compressor power units and turbine starters characteristic in rockets and missiles. Other applications include mechanisms which are exposed to a high level of radioactivity.

Design Advantages

The C/R metal bellows seal consists of a metal bellows — a welded homogeneous unit which is secured at one end — and a carrier ring in which the sealing face is mounted. The seal does not contact the shaft. It is stationary, and the only rubbing surfaces are the sealing face and mating ring. These surfaces are precision lapped to provide a positive seal with minimum friction. At any given pressure, the seal can be designed to maintain proper and constantly effective face loads. It orients immediately to run-out and will resist any torques it is subjected to in operation. The design has high end-play tolerance: Chicago Rawhide engineers have deflected a bellows .100 in. for three million cycles at 1750 cpm and at a

temperature of 500° F. with no adverse effects.

A further advantage is relatively light weight and compactness. The C/R metal bellows seal can be designed for minimum axial and radial space. Axially, complete seals can be produced within a $\frac{1}{4}$ in. cross-section. Radially, dimensions are comparable with conventional end face seals.

The C/R metal bellows seal can also be designed with an extremely low coefficient of expansion. The importance of this factor becomes apparent with the fact that in many applications the operating temperature may change hundreds of degrees in a very few seconds.

Mediums To Be Sealed

Virtually any known liquid or gas may be positively sealed with this design, depending upon duration or service life. From a practical viewpoint, the C/R metal bellows seal is the best design for the sealing of cryogenic and high-energy fuels such as LOX, hydrogen peroxide, fluorine and other missile and rocket propellants.

Where possible, lubrication of the two sealing faces is desirable to prolong service life. However, the medium being sealed commonly acts as the lubricant and may be merely hot gas.

Materials

Sealing faces and mating rings for the C/R metal bellows seal are available in

a variety of materials including carbons, carbides, ceramics and various alloyed metals for both high temperature and corrosion resistance. The bellows can be furnished in any of several metals and alloys such as stainless steel, Monel, Inconel X, Ni-Span C and other special alloy steels.

Consult C/R Engineers

Each application for the C/R metal bellows seal is essentially a custom-design and an intimate knowledge of all conditions to be encountered must be known by Chicago Rawhide engineers to produce the correct combination of properties in the seal. Then, whether you require five, fifty or five thousand seals, Chicago Rawhide will design and produce the correct seal to solve your problem.

Helpful Design Data:

We will gladly furnish you with a design guide and space envelope data concerning the C/R Metal Bellows Seal. Just write for Bulletin MBS-1 on your company letterhead.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1205 Elston Avenue • Chicago 22, Illinois

Offices in 55 principal cities

In Canada: Chicago Rawhide Mfg. Co. of Canada, Ltd.,
Brantford, Ontario

Export Sales: Geon International Corp.,
Great Neck, New York



THOMSON RIVETS offer faster assembly ... greater strength . . . improved performance

Cost-and-method analyses prove that rivets, teamed with automatic rivet-setting machines, cut costs, speed assembly, provide more dependable fastening. That's why auto makers and their suppliers specify rivets on over 500 assembly points on today's models.

75 years' experience in solving fastening problems is the plus you get when J. L. Thomson Mfg. Co. becomes your source of rivets and machines. With over 8000 rivet specifications and more than 200 rivet setting machine models, Thomson is your authoritative source for fastening help.



Write for "Cost Cutting Facts About Fastening With Rivets", a new, complete digest of up-to-date information on rivets and automatic machines. The coupon at right, attached to your company's letterhead, will bring it to you quickly. For more immediate problems, get in touch with your nearby Thomson Fastening Man. He's listed in the Yellow Pages.

*If you plan to attend the Design Engineering Show
see us at booth 625*

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AUTOMOTIVE INDUSTRIES, June 15, 1960

*Thomson Rivets cut costs for such products as
BRAKES, CLUTCHES, DISTRIBUTORS, SWITCHES, RADIOS,
CARBURETORS, WINDOW LIFTS, BODY ASSEMBLIES,
and hundreds of other automotive fastening jobs
from radiator grills to gas tank caps.*



Judson L. **THOMSON** Mfg. Co.
WALTHAM 54, MASSACHUSETTS
Thomson (Canada) Rivet Co. Ltd.
Gananoque, Ontario

Judson L. Thomson Mfg. Co., 630 Sawyer Rd., Waltham, Mass.

- Please rush your new handbook "Cost Cutting Facts About Fastening With Rivets".
-
- Name _____ Title _____
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- Company _____
-
- Address _____
-
- City _____ Zone _____ State _____
-

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(Continued from page 115) pneumatic rack and pinion unit geared to the drive chain through a one-way clutch. Cycling is adjusted to match that of the entire line. In the case of a demonstration workpiece, a gear remained in each compartment for 90 seconds, taking six minutes to pass through all four.

A simple tilting track at the top of the washer turns each gear from horizontal to vertical so that it can roll down the gravity chute

leading to the shaver. Here the work is guided between the two horizontal centers that move in to locate it.

The shaving wheel feeds up from below to mesh with the gear, and drives it in both directions while

cross-traversing the prescribed number of times, the two finish passes being without infeed. The wheel and two centers then retract to release the gear into the final exit chute, while the next in line moves into place. ■

More Government Contract Awards

LATEST contracts awarded by various Government agencies, and covering primarily automotive and

aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, plant equipment, etc. This list is for the period Apr. 31 to May 26, inclusive.

JOHNSON tappets



*for all engine applications

All of the engineering and manufacturing effort at Johnson Products goes into producing a better tappet. Continual experimentation and exacting quality control make JOHNSON TAPPETS worthy of your consideration. Only proven materials, covering a range of hardenable iron, steel, and chilled iron of various alloys, are used in JOHNSON TAPPETS. These tappets are successfully used in jobs ranging from light duty to the most severe, punishing applications. Serving all industry that employs internal combustion engines.



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JOHNSON JP PRODUCTS
MUSKEGON, inc. MICHIGAN

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BENDIX AVIATION CORP., BENDIX SUPPORT EQUIPMENT SECTION, Teterboro, N. J.

Missile contract—\$1,500,000

CHRYSLER CORP., Detroit, Mich.

Missile weapon system—\$3,420,295

CHRYSLER CORP., Detroit, Mich.

Redstone missile system—\$1,134,013

FWD CORP., Clintonville, Wis.

26 Aircraft Fire Fighting Trucks, 1 Rough Terrain Fork Lift, 20 Snow Removal Trucks—\$4,500,000

FWD CORP., Clintonville, Wis.

Truck, Fire Fighting, 25 ea—\$2,946,264

GENERAL ELECTRIC CO., Phila., Pa.

Repair parts for turbines, 441 ea—\$44,547

GENERAL ELECTRIC CO., Schenectady, N. Y.

Turbojet engines—\$10,000,000

ALLISON DIV., GENERAL MOTORS CORP., Indianapolis, Ind.

Modification to a contract, 212 transmission and repair parts—\$1,000,000

CLEVELAND DIESEL ENGINE DIV., GENERAL MOTORS CORP., Cleveland, Ohio

Repair parts for Diesel engines, 15,063 ea—\$72,788

MARMON-HERRINGTON CO., INC., Indianapolis, Ind.

Replacement spare parts, fire, rescue trucks—\$57,028

MINNEAPOLIS-MOLINE CO., Hopkins, Minn.

Fork lift trucks—\$218,000

RANSOME CO., DIV. OF BIG THREE EQUIPMENT CO., Scotch Plains, N. J.

Automatic welding equipment—\$29,407

RAYTHEON CO., Andover, Mass.

Repair parts, missile system—25 line items—\$57,674

SOLAR AIRCRAFT CO., San Diego, Calif.

Turbine-driven power units—\$2,000,000

WESTERN ELECTRIC CO.

Research and development, missiles—\$14,523,807

WESTERN ELECTRIC CO., INC., Greensboro, N. C.

Research and development missile system, missiles and associated equipment—\$9,800,807

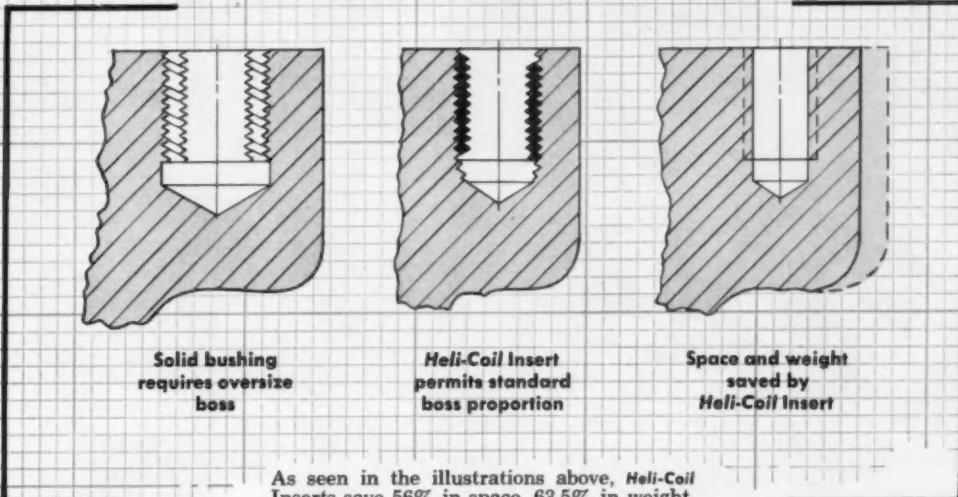
WESTERN ELECTRIC CO., New York, N. Y.

Nike spare parts—\$65,100

WESTERN ELECTRIC CO., New York, N. Y.

Missile system—\$6,210,800

How You Can Save Boss Space and Weight in Thread Design ...with HELI-COIL® Inserts



Heli-Coil stainless steel wire inserts have a smaller outside diameter than any solid bushing. Therefore, with Heli-Coil Inserts you can design boss radii to a minimum, yet stay with standard boss configurations. This

means savings in space and weight, and material-savings as well.

This feature is vitally important for miniaturization in aerospace design, in electrical and electronics equipment design, and for general industrial applications.

NO OTHER TYPE OF INSERT OFFERS SUCH SAVINGS!

Heli-Coil Screw-Thread Insert

Permanently protects threads against wear, stripping, corrosion, galling, seizing, vibration and shock. Made of 18-8 stainless steel wire, cold-formed into a diamond-shaped cross section, work-hardened to a tensile strength of approximately 200,000 psi. Conforms to mil specs and all commercial and industrial thread forms.

Heli-Coil Screw-Lock Insert

Provides same protection as Screw-Thread Insert, PLUS an exclusive patented resilient internal locking feature that eliminates protruding lock nuts, lock wiring and other supplementary locking devices, thus saving additional space and weight. Meets military specifications for locking torque and vibration.

The Heli-Coil line of products includes: inserts and related taps, tools and gages. Tables of boss radius and weight comparison are available.



HELI-COIL CORPORATION
DANBURY, CONNECTICUT

HELI-COIL CORPORATION, 3206 Shelter Rock Lane, Danbury, Connecticut

I'd like more information on Heli-Coil Screw-Thread Inserts Screw-Lock Inserts

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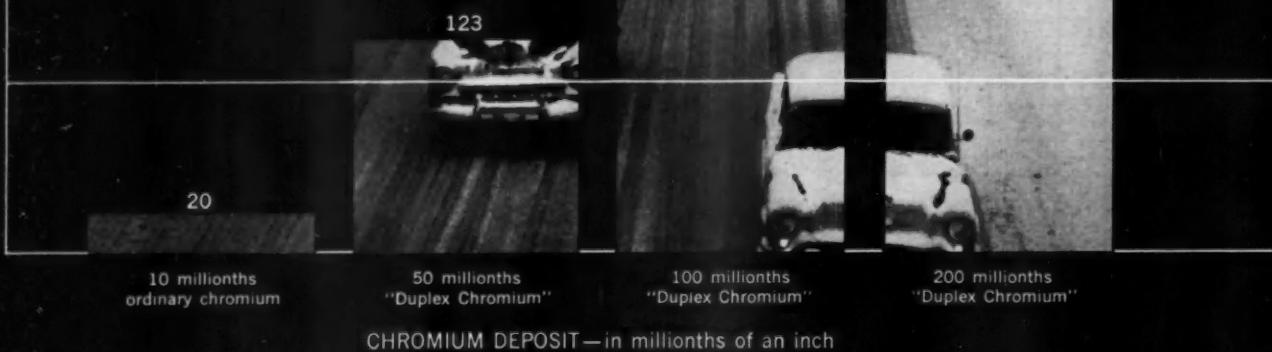
In Canada: ARMSTRONG BEVERLEY ENGINEERING LTD.
6975 Jeanne Mance St., Montreal 15, Que., Crescent 4-3538

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Circle 166 on Inquiry Card for more data →

CASS TEST HOURS

CASS test time during which
ASTM Durability Rating
is maintained at 8 or better



The thicker the "Duplex Chromium" ...the longer the plating lasts

RESULTS with M&T "DUPLEX CHROMIUM" plated over a suitable nickel undercoat confirm that there's a dramatic improvement in durability with 50 millionths of an inch of "DUPLEX CHROMIUM." With 100 millionths it's even better . . . and with 200 millionths, you have the finish of the future.

The graph shows this clearly. These are results with zinc die castings plated with identical undercoats but with different chromium topcoats. See the difference M&T "DUPLEX CHROMIUM" makes in durability. Note that the thicker the chromium, the longer the service life expectancy. Corrodkote accelerated corrosion tests show the same pattern of protection and durability.

Experience shows that the only suitable way to plate thicker decorative chromium is with Unichrome

SRHS® plating solutions. They make possible the correct *type* of deposit. They save production time. They simplify operations. And with only a combination of two of these baths can you produce M&T "DUPLEX CHROMIUM." Unichrome "Crack-Free" Chromium comes first, to block infiltration of corrosives to underlying metal. *Giving more uniform plate distribution*, this bath deposits ample thickness in recesses, with no graying on edges. A subsequent deposit of special Unichrome SRHS® Chromium then follows, to avoid localized corrosion at defects in the basis metal.

SRHS® baths and the "DUPLEX CHROMIUM" process can be adapted to most existing plating operations. Send for the M&T plating engineer to survey your plant requirements, or ask for literature.

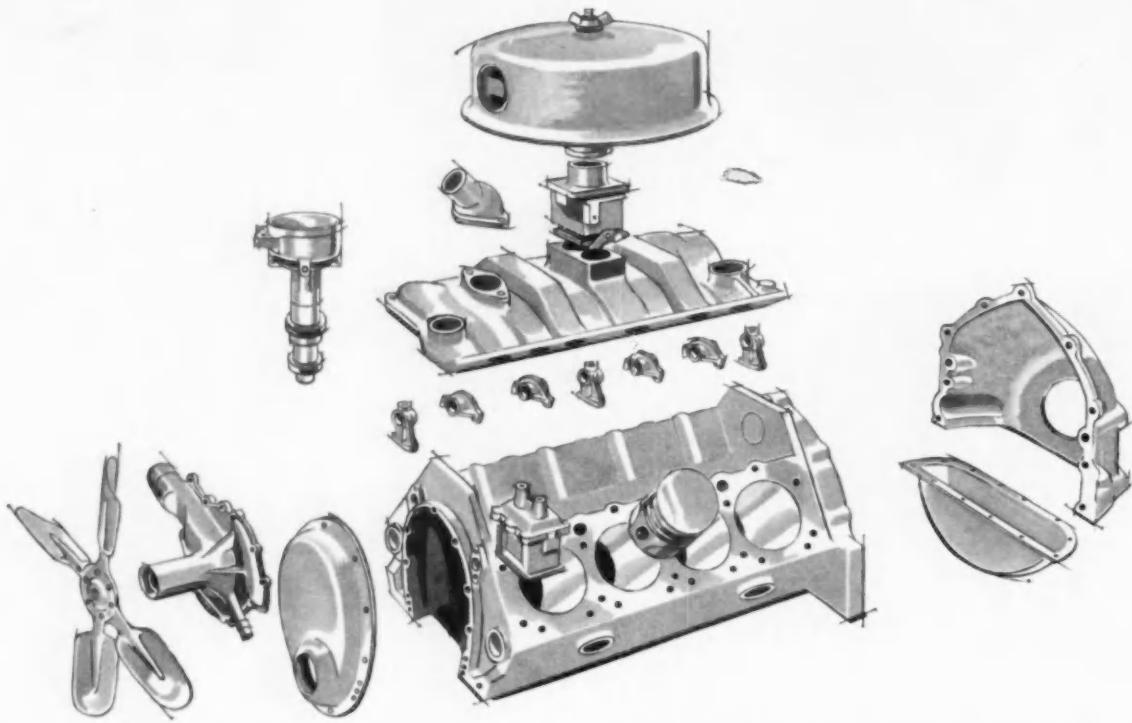


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METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey

**How Aluminum
Functional Parts
cut weight,
improve performance,
reduce costs**





The more than forty different functional parts made with aluminum in the fine 1960 automobiles add up to millions of individual aluminum parts—and there are good reasons for this substantial figure.

The main reason is the increased emphasis on weight reduction, the prime target in compact car engineering and an important objective in the engineering of all automobiles. *Lightweight aluminum is the best solution to weight control.* Another key factor in aluminum's growing usage is new processing techniques that result in a *better part at a lower final cost.* Other aluminum advantages such as corrosion-resistance, strength, and high thermal and electrical conductivity are also important in various applications.

One or more of these aluminum advantages is being put to good use in the representative functional parts illustrated in this advertisement. For example, aluminum's lightness in intake manifolds reduces front end weight, improves handling and weight-horsepower ratio. In the same part, aluminum's high thermal conductivity is of benefit, for example, in manifold probes which transfer exhaust gas heat to the intake manifold to preheat the incoming mixture. Aluminum's high thermal conductivity also helps in carburetor mounting pads through which water from the cooling system is circulated, acting to heat the carburetor and eliminate icing.

Another key advantage of aluminum is the fact that it lends itself to ideal "integration" of physical properties and part function, eliminating assembly com-

ponents and increasing efficiency of performance. For example, in rocker arms and supports, aluminum's high strength to weight ratio combines with die cast designs to take advantage of high production casting techniques with resultant lower cost. The intake manifold and carburetor mounting pad take advantage of aluminum's thermal conductivity, light weight and castability, reducing the number of parts.

These weight and physical benefits combined with production advantages are also important in fuel, oil and water pump components, clutch housings, pistons, carburetor bodies, distributor bases, horn parts, generator end frames and support brackets and many other parts.

Because of aluminum's proved advantages in so many parts, *radiators, alternator and DC generator housings, mufflers, battery straps* and other parts are receiving close design and engineering attention to take advantage of aluminum's light weight and savings in tooling and assembly costs.

For information and assistance on aluminum automotive applications, talk to a Reynolds Aluminum Specialist. Write or phone *Reynolds Metals Company, P.O. Box 5050, Seven Oaks Station, Detroit 35, KEnwood 7-5000. Or contact your nearest Reynolds office or write P.O. Box 2346-MX, Richmond 18, Virginia.*

NOTE: Before you buy any part—have it designed and priced in aluminum. Basic material costs do not determine part costs. New techniques and processes—applicable only to aluminum—can give you a better product at a lower final cost.



REYNOLDS ALUMINUM

the metal for automation

TRADE MARK

Watch Reynolds TV shows: "BOURBON STREET BEAT"
"ADVENTURES IN PARADISE"; and "ALL STAR GOLF" (resuming in October)—ABC-TV



Remember when

HE PROVED HE WAS REALLY CHAMP

His crown wasn't really his, some said. So on June 22, 1938, Joe Louis laid it on the line—against the only man who'd ever licked him. In two minutes and four seconds, Joe smashed the last shred of doubt. Three times the challenger went down. And the third time he couldn't get up.

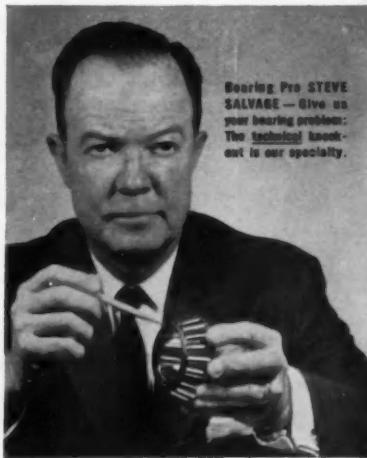
You can tell an old pro by his willingness to stand up and be counted. His skill and experience and heart are the qualities that made him a pro—are the qualities that keep him on top.

It's the quality of product and the skill and experience of its personnel that have given the Timken Company its enviable reputation. This reputation is your safeguard every time you buy a Timken® tapered roller bearing. That's

one reason why we've done more than other manufacturers to give you better bearing value. Like building the world's most modern bearing plant to hold down cost while delivering a better bearing—saving millions of dollars for the auto-

motive industry. And to work to closer tolerances, we created one of the most advanced gage laboratories in industry. This reputation, skill and willingness to help have made Timken bearings the most wanted bearing with purchasing agents and engineers.

Work with the pros of the bearing business. Your Timken bearing sales engineer is ready to work with your people to develop trouble-free bearing applications, help you save on warranty and assembly costs. The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.



Bearing Pro STEVE
SALVAGE — Give us
your bearing problem:
The technical know-
how is our specialty.

TIMKEN®
tapered roller bearings
from the pros of the bearing business

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NATIONAL LOCK FASTENERS

to your "specs"

National Lock Company sales engineers will work with you in solving all your fastener problems. Our extensive engineering and production facilities are geared to handle your requirements for special-purpose or standard fasteners of uniform quality . . . delivered on time.

Write us.



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REGISTERED
TRADEMARK
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TOOL WORKS

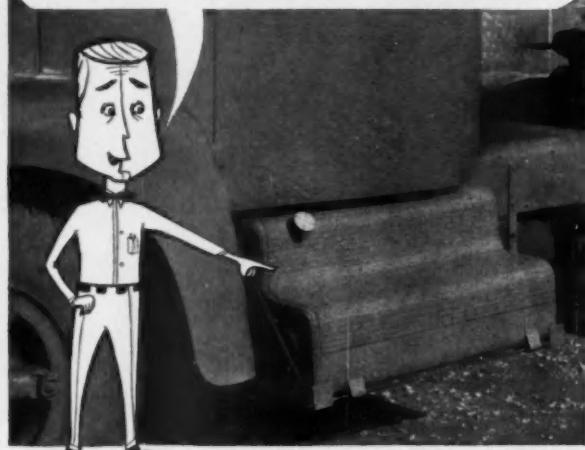


NATIONAL LOCK COMPANY
FASTENER DIVISION

ROCKFORD, ILLINOIS

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LET OUR QUALIFIED SALES
ENGINEERS HELP YOU SOLVE
YOUR FUEL TANK PROBLEMS.



ALWAYS SPECIFY SNYDER

Snyder Tank
CORPORATION

P.O. BOX 14, BUFFALO 5, NEW YORK

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CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping a working surface. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301-L NORTH 11TH ST., ST. LOUIS 6, MO.

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D Y K E M
STEEL BLUE®

Stops Losses
making Dies and
Templates

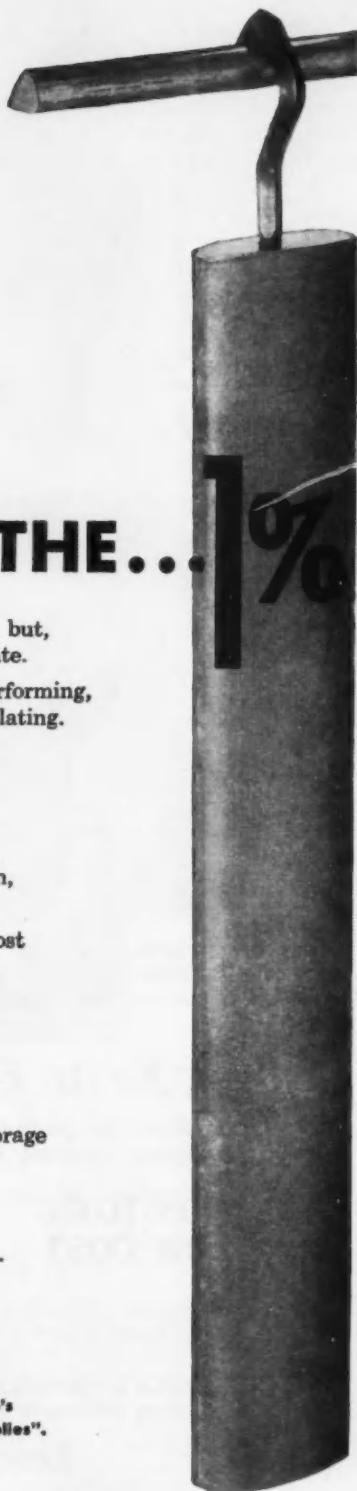


Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench: metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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Metal Finishing in the Body Building Plant

(Continued from page 77)

bodies on which to apply the paint, had the same type of spray booths and ovens, had the same preference for tools, and wanted the same quality of finish, then perhaps an abrasives manufacturer could recommend a list of types to be used and at what stage of the operation to use each of them. But with the many variables involved,

such a recommendation becomes impossible. A run-down of the various procedures and techniques observed in automotive assembly plants will demonstrate this.

First, considering the prime coat or coats, it may be sprayed on or coated by dipping as a combination primer surfacer, or it may be applied as two separate

coats—a primer and a surfacer. Spraying will present different types of flaws to be removed than dipping or flow-coating. Most flaws in dipping are runs and sags, while dust, dirt, overspray, orange peel, sags and runs are inherent to spraying.

All these defects should be removed before the first color coat is applied. The job may be done wet or dry, all by hand, or using power tools on the larger surfaces and hand operation on the smaller, difficult-to-reach areas. If a dry machine operation is preferred, either a jitterbug sander using 3 2/3 in. by 9 in. sheets, or a slow speed 1500 rpm rotary air tool using a flexible back-up pad and 8 x 0 hole disks can be used. The abrasive for these operations should be a 220 or a 240 grit Dri-Lube finishing paper, a silicon carbide product oversized with zinc stearate to prevent loading. If only a light hand scuffing is preferred, finishing paper, the same product without zinc stearate, may be used. Use the lowest cost product that will do the job—don't use waterproof paper, a high-cost item, on a dry operation where a lower-cost product like finishing paper or Dri-Lube finishing paper will work.

The resulting dust of a dry sanding operation must be completely removed from the sanded surfaces before the color coat is applied. This is generally done using benzine-soaked rags, and because of the additional labor required, it is not a popular procedure.

Wet sanding of prime coats can be worked all by hand, or, like the dry operation, using power tools and hand operations. Two coated abrasive products are being used currently for hand operations: waterproof paper with coatings of aluminum oxide or silicon carbide, 280 to 360 grit. These same products are also used on jitterbug sanders and rotary tools. Another abrasive product, sand screen, aluminum oxide coated in 320-400

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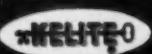
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grit, is used on either of these power tools and is fast becoming the most used product in wet prime sanding. More frequently used on a rotary tool, it requires no adhesive to hold it on the flexible pad, since this product is coated on both sides and normal pressure of the pad against the body will keep the sand screen disk in place while the pad is rotating. Its open mesh construction provides a self-cleaning characteristic that keeps the disk cutting until the grain is gone. The grain coating on both sides enables it to be used twice, greatly increasing the mileage.

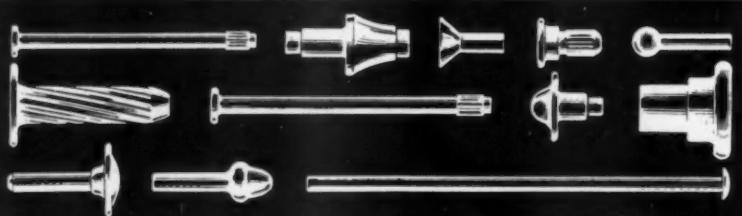
In any wet operation, plenty of warm water must be supplied by perforated pipes or sprays over the bodies, and dip tanks for soaking waterproof paper and washing sludge from sand screen disks should be handy to the line. Power tools can be equipped with a $\frac{1}{4}$ in. water line controlled by a thumb valve to supply ample water while sanding. Insuring a plentiful flow of water while sanding will improve the rate of cut and reduce

the necessity for a sludge washing operation later.

Sanding between color coats, if done, can be done wet or dry. Here again, use a waterproof paper product only if water is being used, otherwise the less costly finishing paper or Dri-Lube finishing paper will do.

Silicon carbide waterproof paper has been more popular than the aluminum oxide coated product in the past. However, with the development of harder, more durable paints of different resinous bases, the aluminum oxide product has provided a better finish for several plants. The initial cut of this type is less than that of silicon carbide, but the mileage is greater so the usage of the aluminum oxide will be less. The objection to this product has been mainly from the men on the line—the initial cut feels different and the color of the abrasive coating is different. However, because of the better finish produced, we believe its usage will continue to grow in spite of the objections from the line.

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coming into much wider use and passenger cars having this finish have gone as long as three years without polishing. Aluminum oxide waterproof paper tends to sand the undercoats employed under this finish effectively, and wherever these types of finishes have been used, aluminum oxide has given superior life and paper usage has dropped by 25 per cent. This can result in several thousand dollars' saving per plant within a model year.

Each method — hand sanding, using jitterbug sanders or rotary type sanders with a flexible pad — has its advantages and disadvantages which should be considered in an effort to improve economy. Hand sanding is considered slower and more labor consuming; but less paint is removed by sanding, eliminating cut-through and thin areas, and a hand sander can feel the surface as he works. With both power tools mentioned, the tendency is to work over the entire area too often, which will cause a lot of paint being removed unnecessarily. Many jitterbug operators are careless in tearing off the sheet of worn paper, with the result that two or more are often discarded. Jitterbugs are better applied on flat surfaces because of the rigid support of the abrasive which results in cut-through and thin spots on curved surfaces. Careless handling of rotary tools results in the flexible pads being torn, through catching on door edges, burrs, and holes. If paper-backed disks are used on a flexible pad, they must be removed carefully or the sheet rubber cover on the sponge pad will tear. Disks should be removed at the end of the shift, while the disk and pad are still warm from use because the adhesive will get tackier as it cools off and cause the pad to tear when the disk is removed.

Final color coats in the enamel system are not sanded due to the nature of the material itself. In the enamel system, sanding is done only to the undercoat in order to assure a level surface prior to the application of the final color coat. In the lacquer system, it is sometimes necessary to sand the final finish with waterproof paper using either the rotary method or the so-called "jitterbug" method. The grit

size usually employed on this operation is 400 grit silicon carbide waterproof paper, and it is quite common to use an "oil" lubricant on this operation. The purpose here is to remove the heavy orange peel prior to polishing. With improvements in painting procedures, less of this work has to be done and generally it is restricted to the high-lighted areas, such as the hoods.

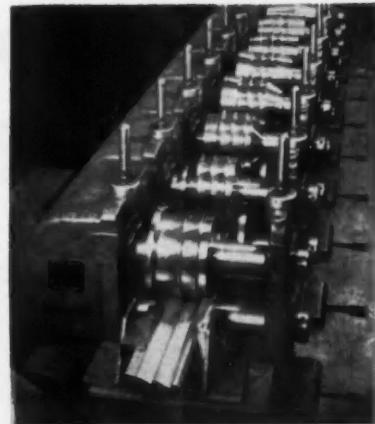
As long as cars are produced, it is necessary to have a repair area to service bodies that have been scratched or otherwise damaged in the normal process of manufacturing. If dry repair work is to be done, finishing paper, a non-waterproof product, should be used because of its cost and design. This type of product has a so-called "open coat" which leaves space for the abrasive to clean itself in application. If it is necessary to do repair work wet because of the loading tendency of the finish, aluminum oxide waterproof paper in 320 grit is the most preferable commodity. Until recently silicon carbide has been the usual product for this type of application.

Reviewing these cost cutting angles:

1. Good bodies must be received at the paint department.
2. Spray booths must be modern and equipment properly used and maintained.
3. Drying ovens must be properly operated.
4. Coated abrasives must be properly stored.
5. Coated abrasives consumption should be carefully checked and its usage rationed.
6. The proper abrasive must be used for each job.

Following these suggestions should not require any undue effort on the part of any paint superintendent or paint line foreman. It will require cooperation from the body line and the cooperation of every man on the paint line. The necessity of this cooperation may seem like a big order, but after considering the savings possible, it will be well worth the effort. ■

This is the second and final part of a two-part article devoted to metal finishing by R. D. Bottenfield and F. J. Quinn.



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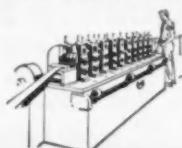
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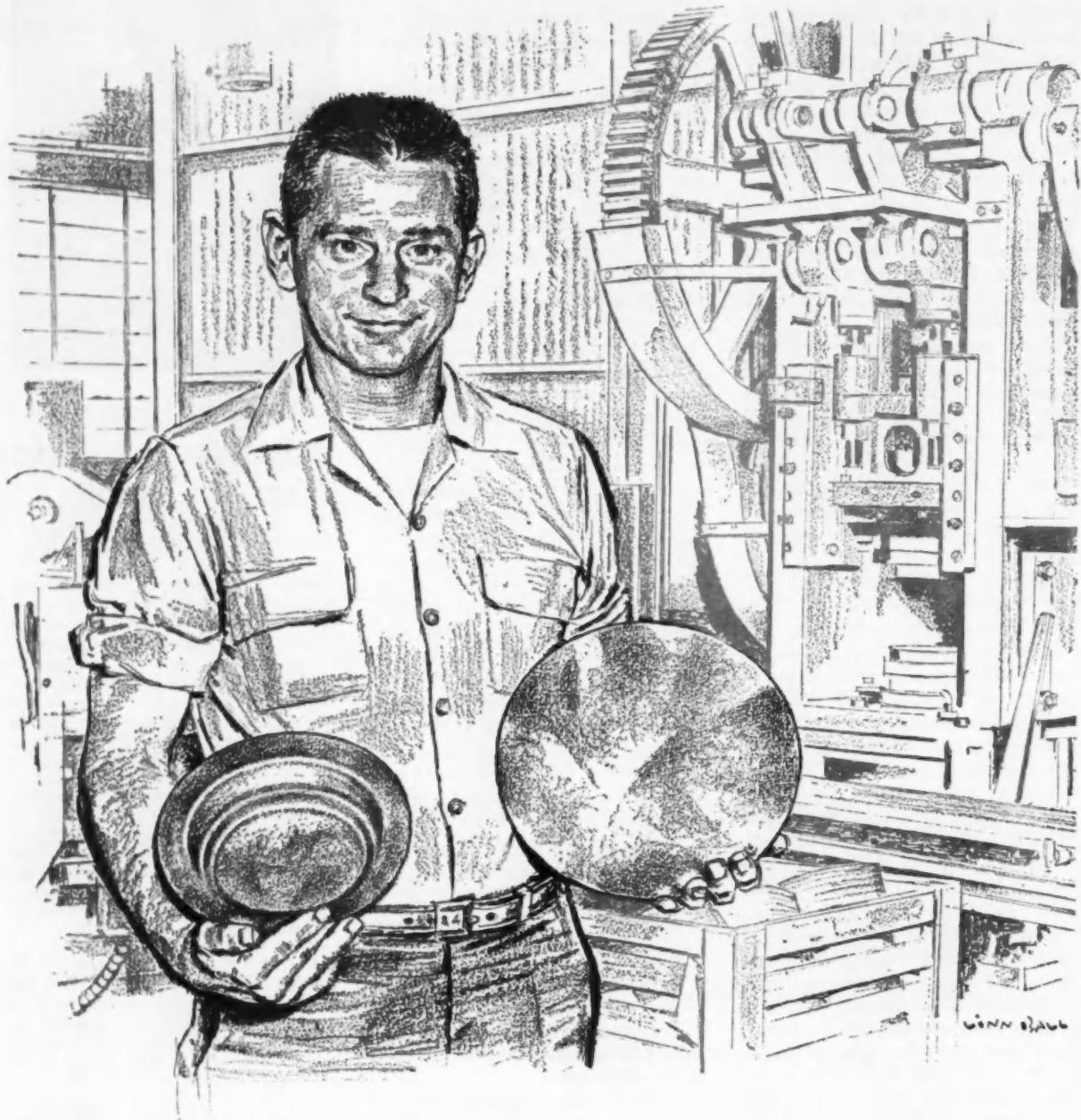
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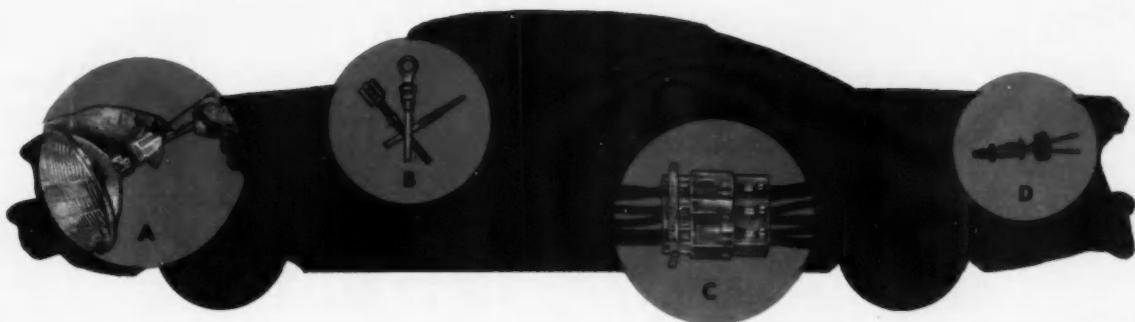
JOHN SHRAGG, Foreman of the
Press Dept., Ekco Products Company

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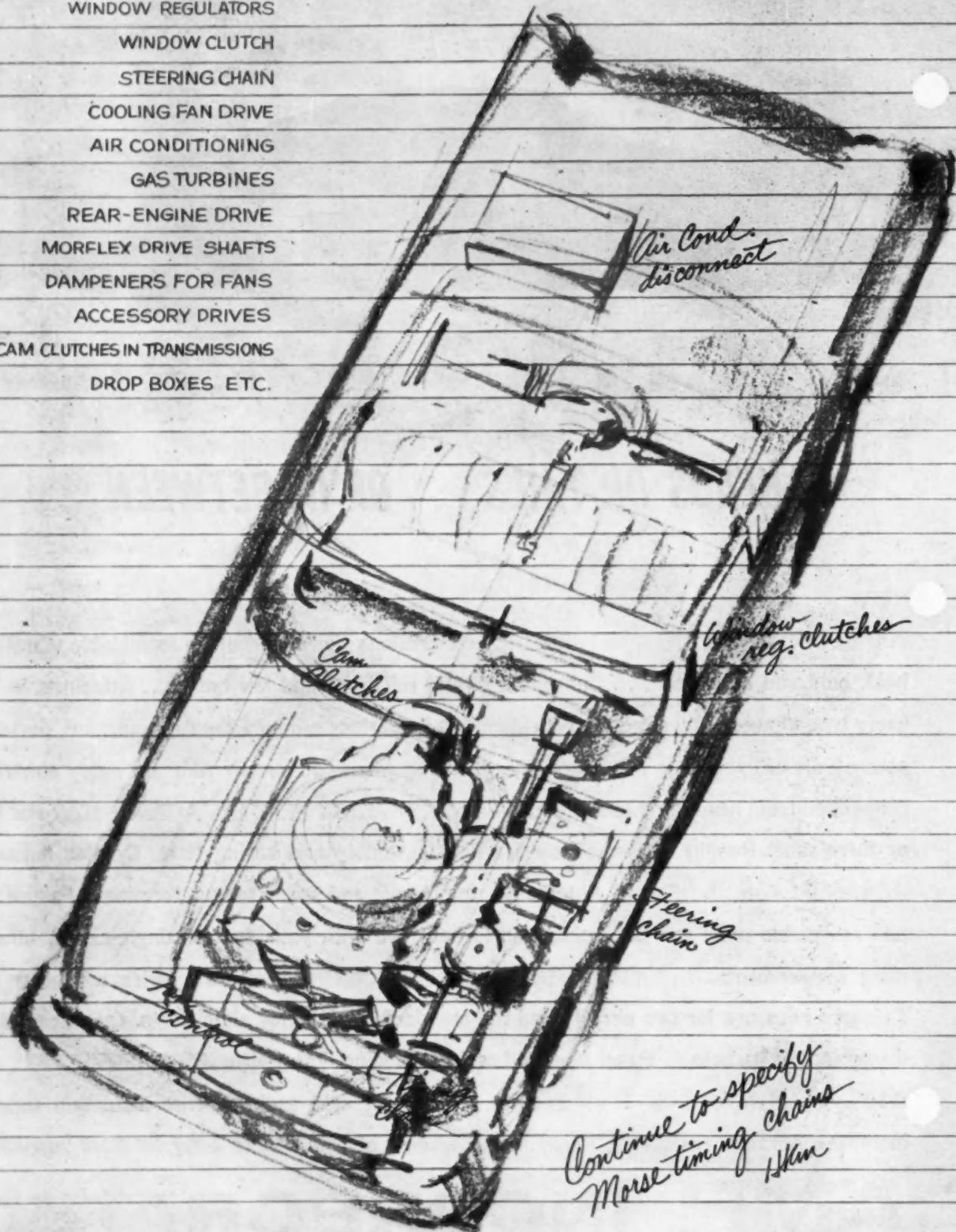
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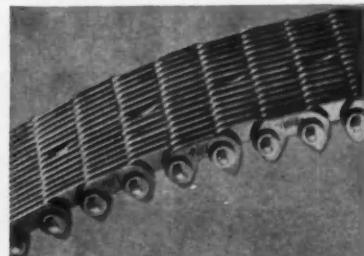
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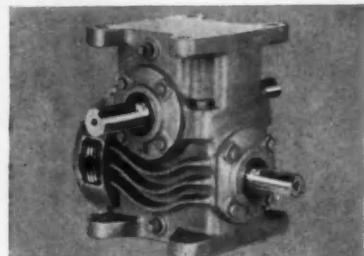
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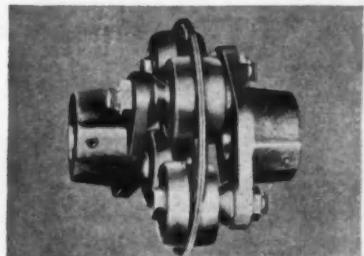
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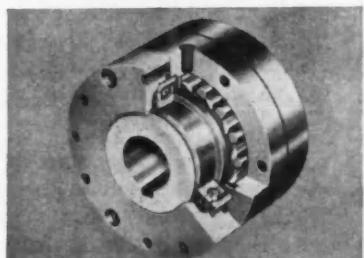
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For further details write for Engineering Data Catalog, Section D

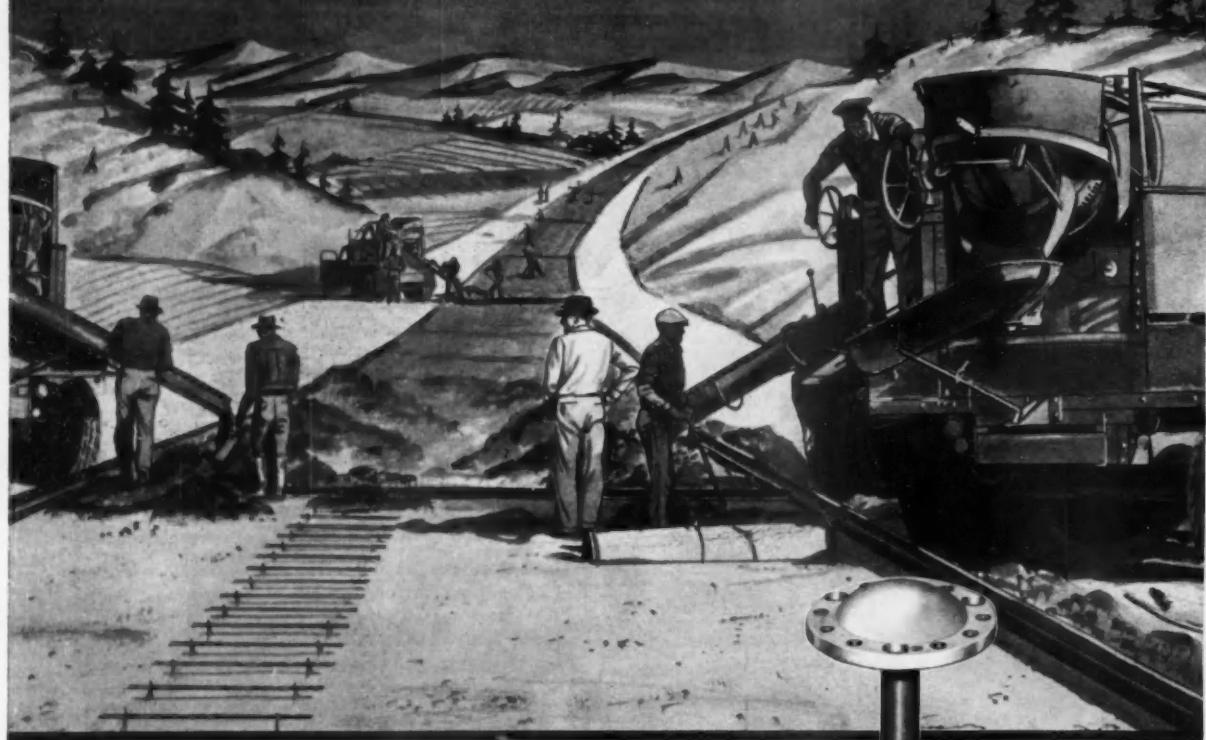
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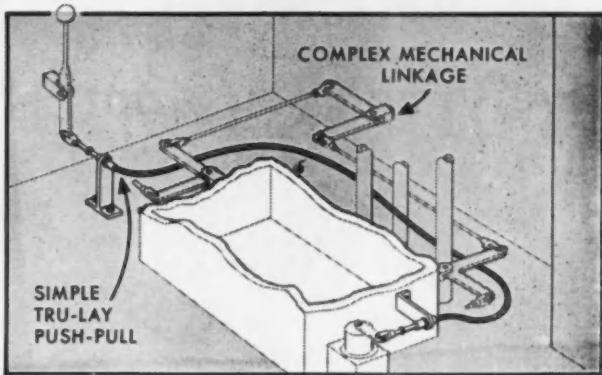
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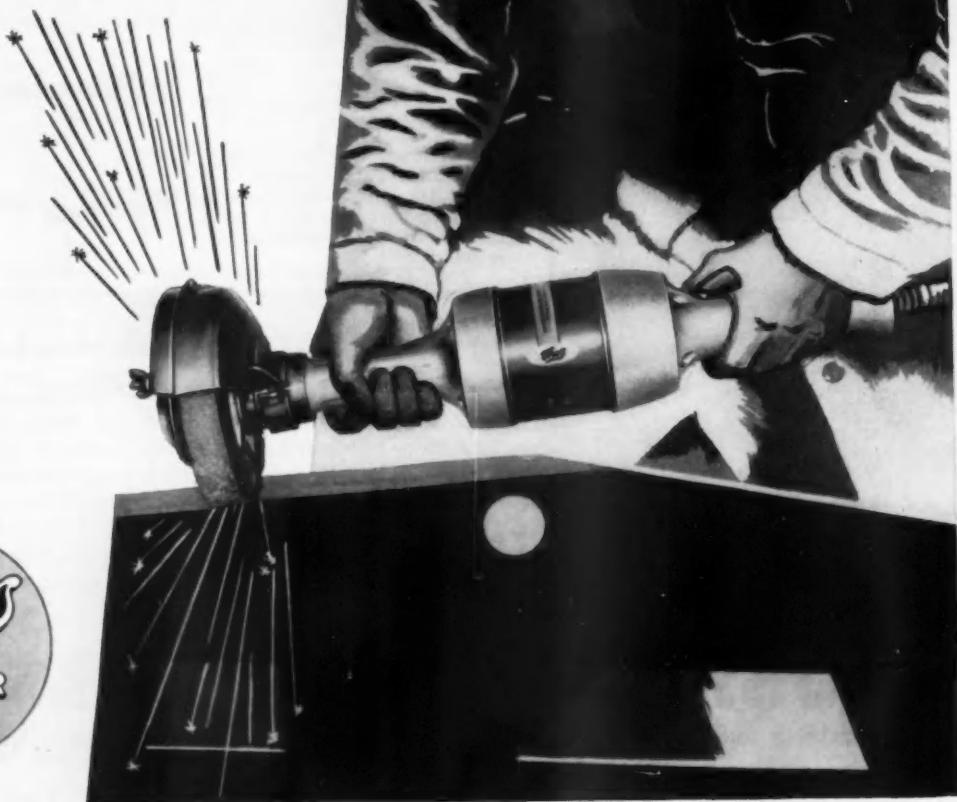


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THE BORG-WARNER PLASTIC THAT'S TOUGH, HARD, AND RIGID

Skycrafters Corp. used CYCOLAC to unusually good advantage when they designed their unique new meal tray carrier for airlines. The carrier has an inner and outer skin of CYCOLAC with Urethane foam insulation in between.

This revolutionary "sandwich" construction was so sturdy that it completely eliminated the need for any type of support frame and provided superior thermal insulation. In addition, CYCOLAC, the tough, hard, rigid ABS plastic from Borg-Warner, withstands the use and abuse of constant handling and stands temperatures from that of dry ice to wash water at 205°.

It may be the material **you** need.

CYCOLAC Better in more ways than any other plastic

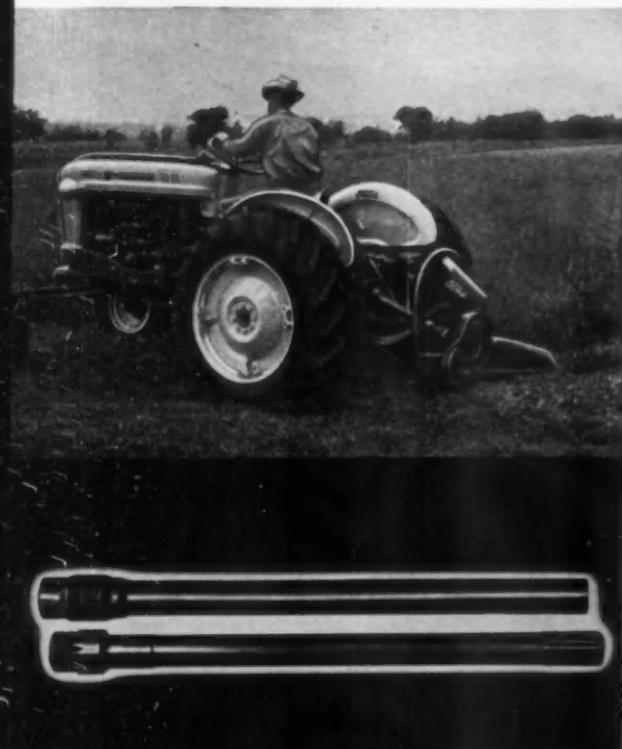
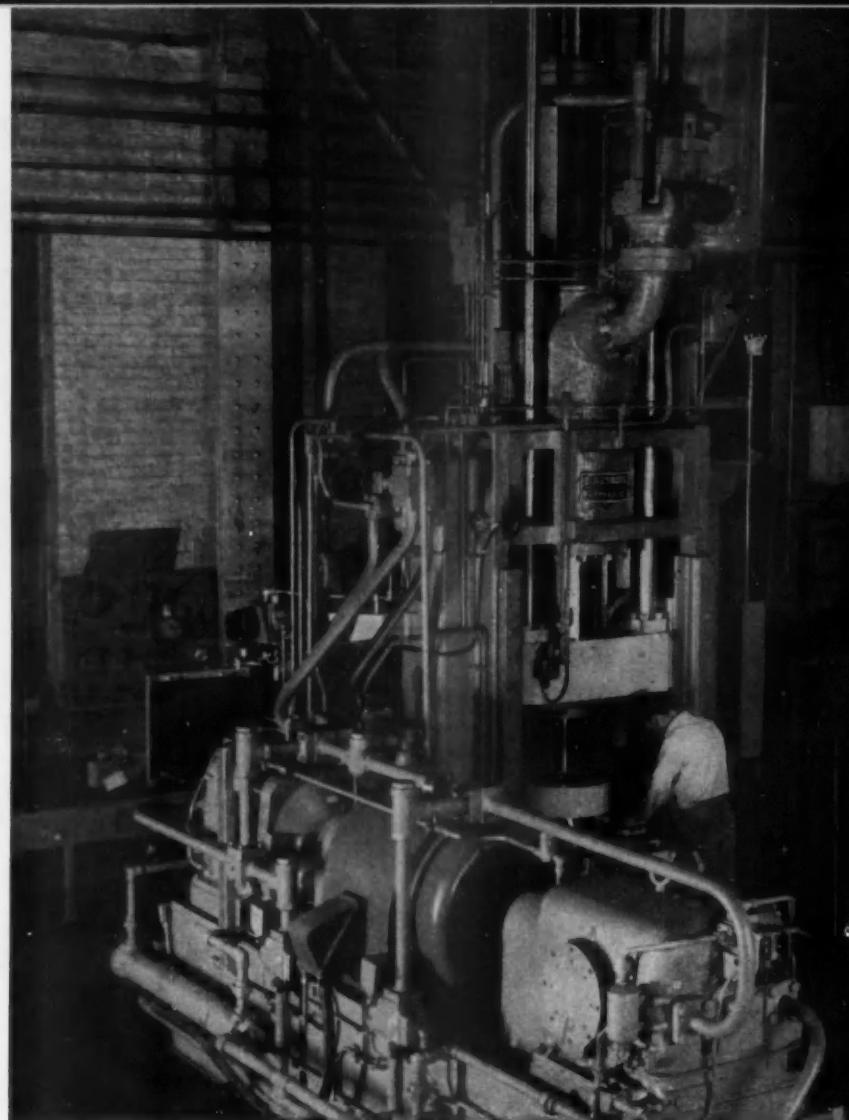
GET THE FACTS—WRITE TODAY!

MARBON CHEMICAL
WASHINGTON



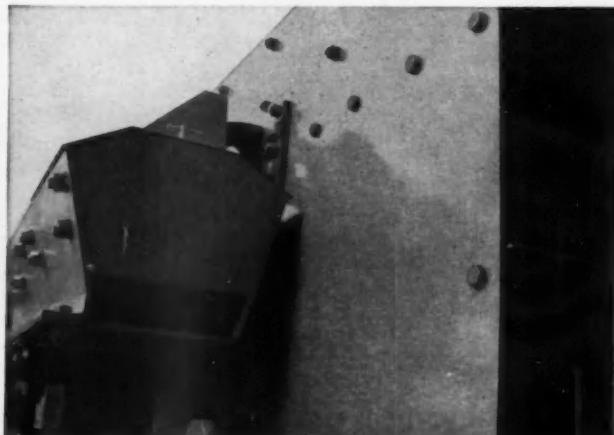
DIVISION BORG-WARNER
WEST VIRGINIA

This 500-ton hydraulically operated press built by Birdsboro Steel Foundry & Machine Company, Birdsboro, Pa., and featuring Republic ELECTRUMITE Hydraulic Fluid Line Tubing, is used by a leading research center for deep drawing, extruding, or planishing metals.



REPUBLIC DIE-FORM CUTS PRODUCTION COSTS. Ford Tractor Power Take-Off Counter-Shaft costs less to produce using a Republic Die-Form Blank, as compared to previous materials. Because Republic Die-Form Blanks closely approximate the completed part, they minimize required machining and reduce handling costs. In addition, the nature of the Die-Form Process improves machinability of any given analysis, permitting further savings through use of higher speeds and feeds. Photo below shows a Die-Form Blank and the completed shaft as featured in the Ford Tractor. Write for Die-Form Folder ADV-746.

REPUBLIC CAP SCREWS PROTECT SHAKER SCREEN PERFORMANCE. Sorting and sizing ton after ton of jolting, jarring, abrasive material is all in a day's work for Ty-Rock Vibrating Screens, built by The W. S. Tyler Company, Cleveland, Ohio. Satisfactory performance under these brutal conditions not only requires design and manufacturing skill, but a thorough knowledge of materials. Maximum performance under all operating conditions is typical of Republic's complete line of top-quality Cap Screws. Send coupon for data.



Stubborn resistance to fatigue...

REPUBLIC ELECTRUNITE HYDRAULIC FLUID LINE TUBING

Machine tool builders and operators depend upon Republic ELECTRUNITE® Hydraulic Fluid Line Tubing for stubborn resistance to fatigue. Reason is the *consistent uniformity of concentricity* and mechanical properties of ELECTRUNITE welded steel tubing—characteristics that make this tube better able to withstand the vibrations of rapid multiple cycling.

This uniform concentricity—inherent in the ELECTRUNITE process—coupled with uniform heat treatment, insures uniform flaring characteristics. Uniform ductility assures easy bending. Both mean savings in original and in replacement installations.

You can recognize this best of all hydraulic line tubing by the blue spiral marking stenciled end-to-end on every length. It is your assurance of genuine ELECTRUNITE quality. The spiral marked tube is available in all sizes shown in JIC Standards, and is produced in a wider size range to Specification HL-1, which meets all JIC Standards test requirements.

Get all the facts. Discover how Republic ELECTRUNITE Hydraulic Fluid Line Tubing can substantially reduce maintenance costs in the most complicated installations. Call your Republic representative, or send coupon for additional information.



REPUBLIC WEDGE-LOCK PARTS® STORAGE UNITS are easy to load and unload from either side. And, the heavier the load, the tighter the grip, because patented Wedge-Lock construction includes a post that will not buckle, a concealed sway-proof joint, and a reinforced shelf that does not sag. Unlimited shelf arrangements. Capable of exceptionally high stacking. Republic Storage Engineering specialists will help you plan. Call your Republic representative today.



REPUBLIC STEEL

*World's Widest Range
of Standard Steels and Steel Products*

REPUBLIC STEEL CORPORATION

DEPT. AI -9532

1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on the following products:

Republic ELECTRUNITE Hydraulic Fluid Line Tubing Republic Die-Form—Folder ADV-746
 Republic Cap Screws Wedge-Lock Storage Units

Name. _____ Title. _____

Firm. _____

Address. _____

City. _____ Zone. _____ State. _____

All from 1 source...WAGNER

Complete straight air...air/hydraulic ...hydraulic braking systems **FOR HEAVY-DUTY VEHICLES**

When you specify braking systems for heavy-duty vehicles, you can choose the system best suited to your needs, and get the complete system from Wagner. Only Wagner can supply components for all braking systems—everything from actuating systems to foundation brakes for straight air, hydraulic,

or air-over-hydraulic brakes. The two new components and the time-proven rotary air compressor shown below point out the product development and the years of experience that have kept the name Wagner Lockheed first in braking for many years.

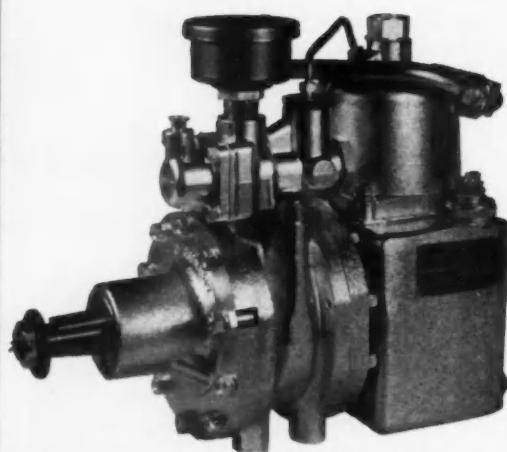
HEIGHT CONTROL VALVE



Used with vehicles equipped with air suspension to keep the floor height constant despite variations in loading. Efficient air usage sharply cuts compressor pumping time—lengthens compressor life.

AIR CAM BRAKE

Designed for outstanding performance, this brake is completely interchangeable with Wagner Lockheed hydraulic foundation brakes. Standardization on Wagner brakes can simplify vehicle assembly lines—reduce inventories on axles—speed production.



ROTARY AIR COMPRESSOR. Proved by billions of miles of low maintenance service on thousands and thousands of vehicles. It provides all the advantages that only rotary compression can bring: rapid pressure recovery...cooler operation...smoother operation...quieter operation and longer operating life.

CONSULT YOUR WAGNER AIR BRAKE SPECIALIST

Let him help you with your specifications, and also ask him about the engineering consulting service available from Wagner.



Wagner Electric Corporation

6363 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

LOCKHEED BRAKE PARTS, FLUID, BRAKE LINING and LINED BRAKE SHOES • AIR HORNS • AIR BRAKES • TACHOGRAPHS • ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES

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Easier Way to Make Prototypes

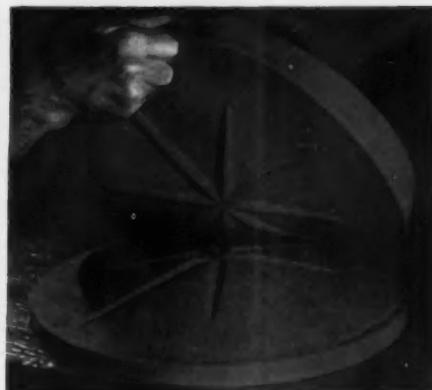


↑ STEP 1

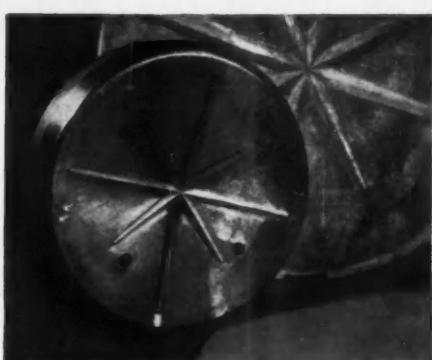


STEP 2 →

*Case History: Making
Hub-cap Embossing Dies*



STEP 3



STEP 4

SILASTIC RTV Molds Strip SILICONE RUBBER Fast and Easy

Silastic® RTV, the Dow Corning liquid silicone rubber that vulcanizes at room temperature, provides a new and better way to make prototype parts. This fluid rubber is easily poured into, over, or around complex shapes, and sets up in a short time. The result is a strikingly accurate mold, into which you can pour many casting materials such as plaster, waxes or plastics. Because Silastic RTV will withstand temperatures up to 500 F, many molten metal alloys can also be cast. Silastic RTV strips readily from most materials without loss of pattern detail. Here's how one automotive industry supplier — Cadillac Stamp Co. — uses Silastic RTV to make templates for hubcap embossing dies.

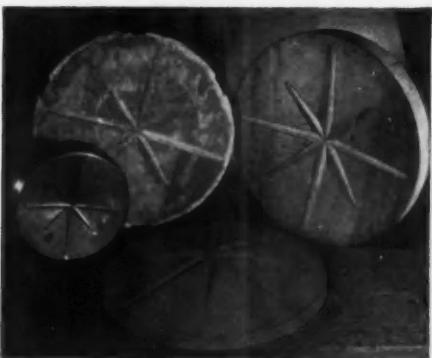
Step 1. A wood pattern was machined to the exact configuration of the hubcap design. The intricate design requires a material that releases easily without loss of detail. Silastic RTV has been poured on the pattern to make a "negative" mold.

Step 2. The Silastic RTV mold is then used to cast a plastic. A "positive" image that faithfully reproduces the original pattern results. This image forms a template or prototype from which a pantograph-type engraving machine can sink dies.

Step 3. Now we return to the rubber mold, and this time more Silastic RTV has been poured into it. A rubber "positive" results. The two rubber molds release readily and two exactly matching parts result.

Step 4. From the rubber "positive", another plastic image is cast. Silastic RTV strips off easily . . . a crucial factor. The second plastic template is now ready for the engraving machine to sink dies. Size is reduced by one-half in the process. Note size of finished hubcap.

Step 5. Here are all the steps reassembled. Remember — both embossing dies were made from one wood original, thanks to Silastic RTV. Throughout the process there has been no loss of pattern detail . . . and exactly matched dies have been made.



STEP 5

Is there a way that this easy handling and faithful reproduction can help you? We'll be glad to assist in adapting Silastic RTV to your operations.

Free Sample. Write on your letterhead for data and sample of Silastic RTV. Address Dept. 0906

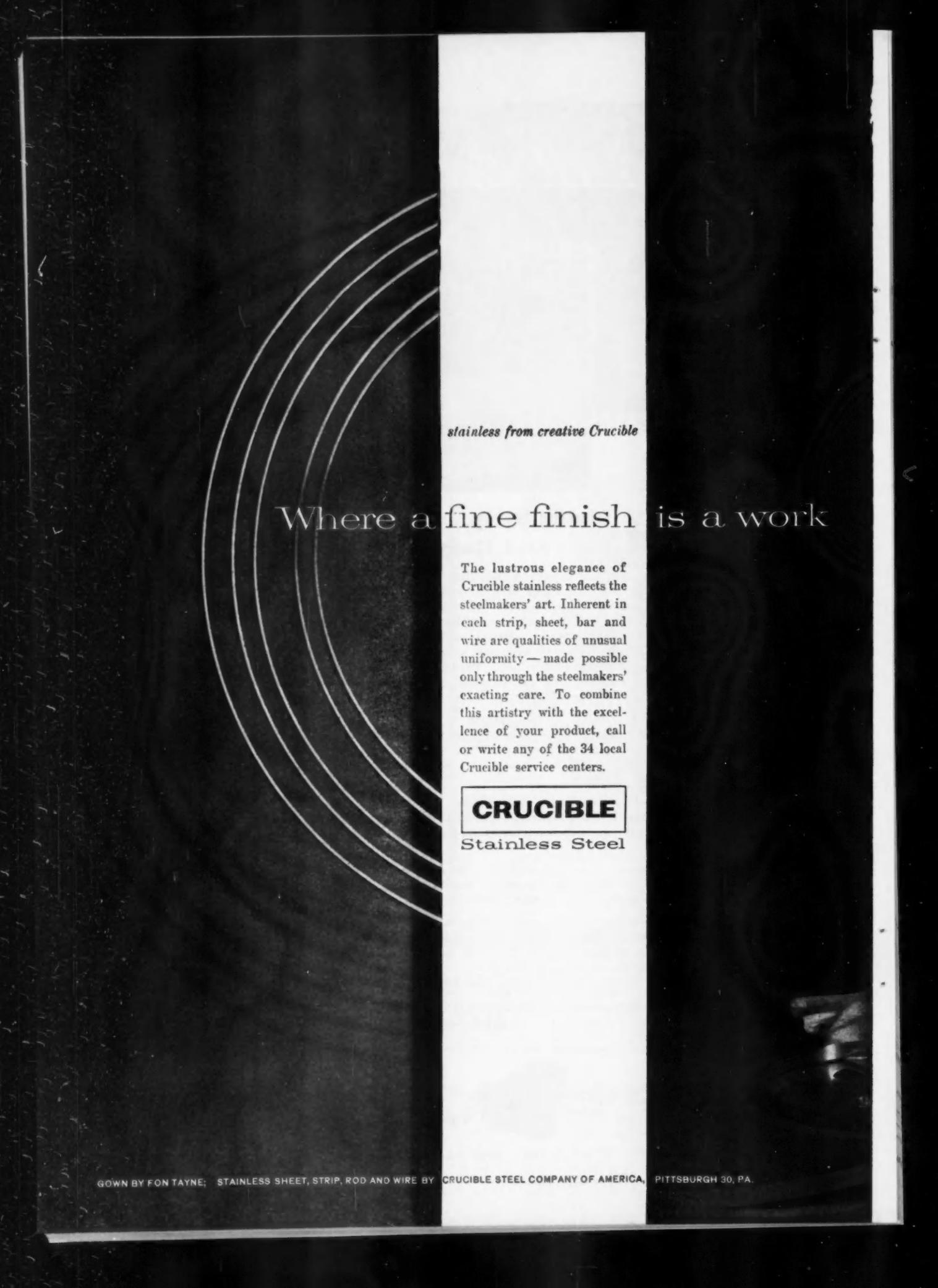


Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

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stainless from creative Crucible

Where a fine finish is a work

The lustrous elegance of Crucible stainless reflects the steelmakers' art. Inherent in each strip, sheet, bar and wire are qualities of unusual uniformity — made possible only through the steelmakers' exacting care. To combine this artistry with the excellence of your product, call or write any of the 34 local Crucible service centers.

CRUCIBLE

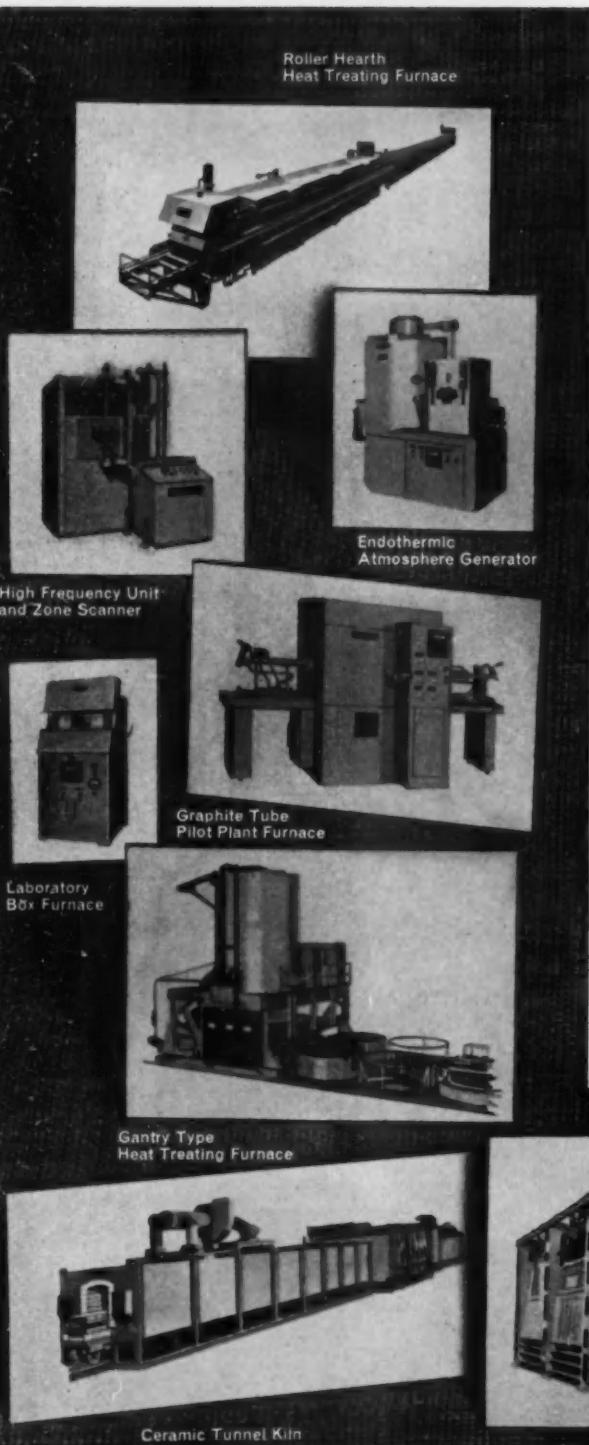
Stainless Steel

of art



THE BIGGEST INDUSTRIAL HEATING JOB CAN BE ENTRUSTED TO LINDBERG'S PLUS DIMENSION IN SERVICE

**THERE'S LINDBERG EQUIPMENT FOR
EVERY INDUSTRIAL HEATING NEED**



The plus dimension in service Lindberg offers today can provide a complete answer to any problem requiring the application of heat to industry. Give us your specific requirements for a part or a product and we will develop the right processes, design, engineer and install equipment and facilities.

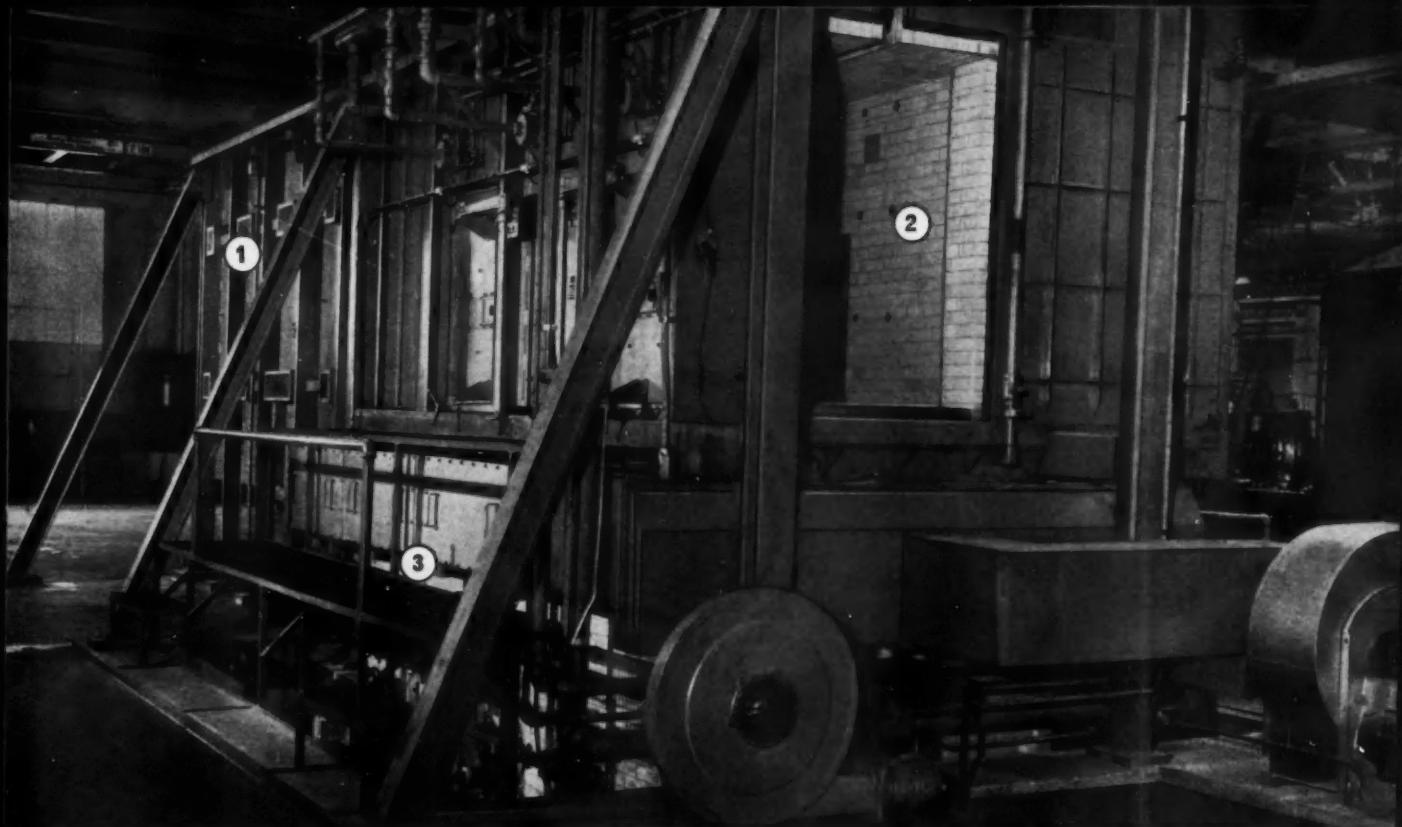
This service covers broad requirements—from plant layout and construction to automated production lines, or just specially engineered industrial heating equipment efficiently integrated into your production processes. For example, Lindberg Industrial Division has recently completed or is in the process of installing such varied projects as:

- Complete plant layout and equipment for brazing honeycomb
- Complete installation for heat treating raw aluminum products including furnaces, foundations, roof and lighting
- A fully automated production line for heat treating plow shares
- Two large ceramic kilns embodying a new concept of making high-refractory bricks
- Complete, automated production line for enameling and drying hot water heaters

You obtain many advantages from Lindberg. You get the combined skills of what we believe to be the country's finest group of engineers and technicians in the industrial heating field. Our experience covers the whole range of "heat for industry" methods so you can rely on us to recommend the most suitable equipment and processes. You will get your installation from one responsible source, guaranteed to achieve the results you need and ready to go to work at the turn of a switch.

Lindberg Industrial Division, Lindberg Engineering Company, 2321 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

These are representative units from complete Lindberg lines in all types of industrial heating equipment.



This Lindberg installation at Stewart-Warner Corporation, Indianapolis, combines (1) Pre-heat Furnace (2) Holding Furnace and (3) Lindberg-Upton Salt Bath Furnace.

LINDBERG SUPPLIES COMPLETE INSTALLATION FOR DIP BRAZING ALUMINUM HEAT EXCHANGER CORES

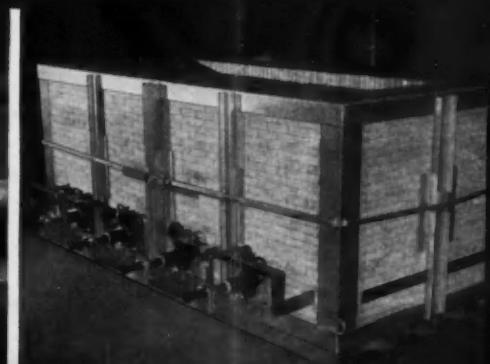
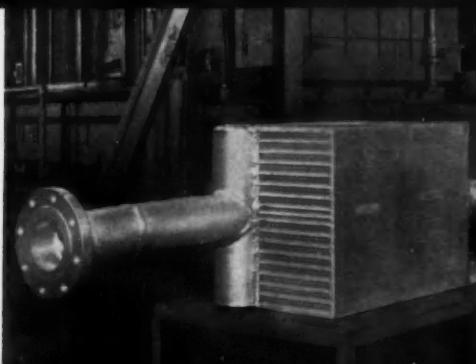
Brazing large aluminum plate-and-fin heat exchanger cores requires close tolerances and precise controls. Stewart-Warner Corporation, Indianapolis, chose Lindberg Industrial Division to design and install the right equipment to perform this exacting process efficiently and economically. The main unit, shown above, combines Lindberg Pre-heat and Holding Furnaces and Lindberg-Upton Salt Bath Furnace. Cores are brought to the desired temperature, moved to holding furnace section, then lowered into the salt bath. Automatic controls maintain required salt bath temperature to extremely close limits. Braze cores are raised

to holding furnace for drainage, moved through a cooling chamber, steam cleaning booth and five dip rinse tanks for thorough cleaning. This installation is another example of the complete design, engineering and installation service Lindberg Industrial Division offers industry. Whenever you have a product or process requiring the application of heat, consult your local Lindberg Field Engineer, (see your phone book) or write us direct. Lindberg Engineering Company, 2491 West Hubbard St., Chicago 12, Illinois. Los Angeles plant: 11937 South Regentview Ave., Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

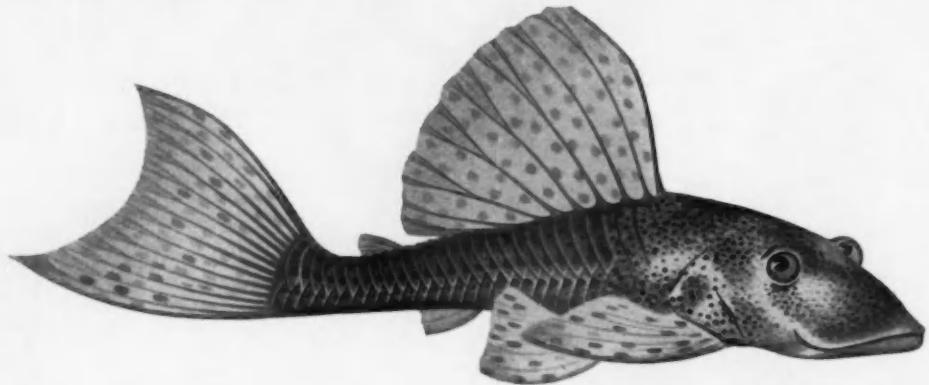
Design of unit permits convenient movement of cores through pre-heat (foreground) to holding section (at far end).

The aluminum heat exchanger cores being brazed in the unit have heat transfer surfaces of 8000 sq. ft. or more.

Lindberg-Upton Salt Bath Furnace in unit features exclusive Graphite "Continuing" Electrodes, and has a capacity of more than 12 tons molten salt.



To identify a strange fish...



you call in an **ICHTHYOLOGIST**

(specialist in fish life)



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AUTOMOTIVE INDUSTRIES, June 15, 1960



to cut production costs...

you call in LINCOLN

(specialists in arc welding)

BECAUSE of high operating costs a Maryland barge builder had trouble meeting competitive prices. The LINCOLN Field Engineer recommended a semi-automatic "Squirt" welder. On heavy plate it was four times faster and reduced overall costs due to reduced plate preparation and cleaning time.

As a matter of fact, right there is a good reason for doing business with LINCOLN. Cost reduction is a sort of religion at LINCOLN where production costs have dropped as much as 50% in the last 20 years. It's the result of LINCOLN'S world-famous cooperation between employees and management where everybody gets paid according to his own contribution to the company's goal—superior products and service to you at continually decreasing costs.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

To learn how LINCOLN can be of service to you, write today

THE LINCOLN ELECTRIC COMPANY

Dept. 1710 • Cleveland 17, Ohio

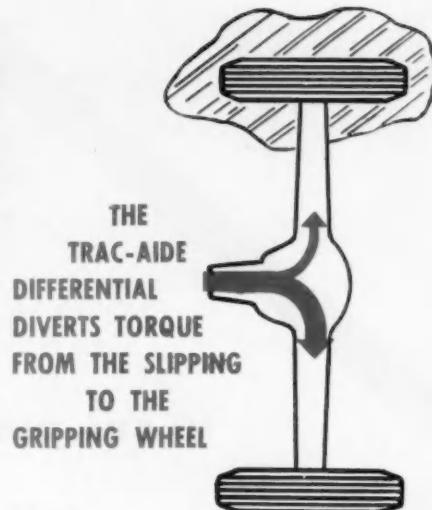
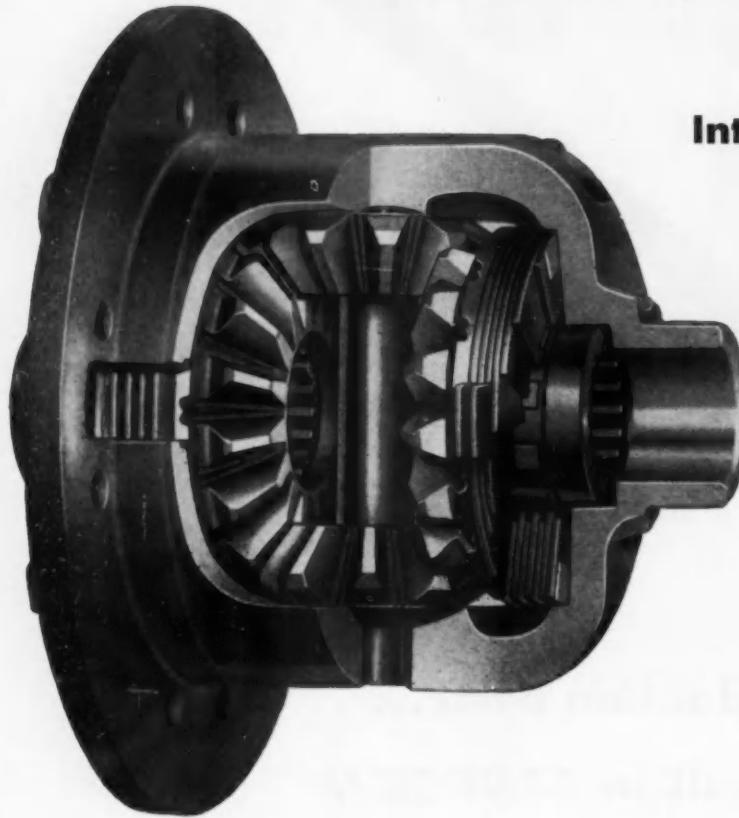


The New

TRAC-AIDE DIFFERENTIAL

by EATON

Introduces Long-Awaited
Design Features



The TRAC-AIDE Differential by Eaton is a conventional differential, plus a simple non-locking, multi-disc friction clutch which automatically engages to retard motion of the slipping wheel, and provides smooth, chatter-free transmission of torque to the wheel with the greater traction.

The secret of the Eaton TRAC-AIDE Differential is the coefficient of friction designed into the clutch discs. This provides a stable, durable bias ratio that assures chatter-free operation without the use of special lubricants. With fewer parts and one-piece case, this economical unit is easily adapted to varied axle designs for cars and small trucks.

The Eaton Differential makes a distinct contribution to more dependable vehicle operation. We will be glad to discuss the unique design features of this new Eaton Differential with your engineers.

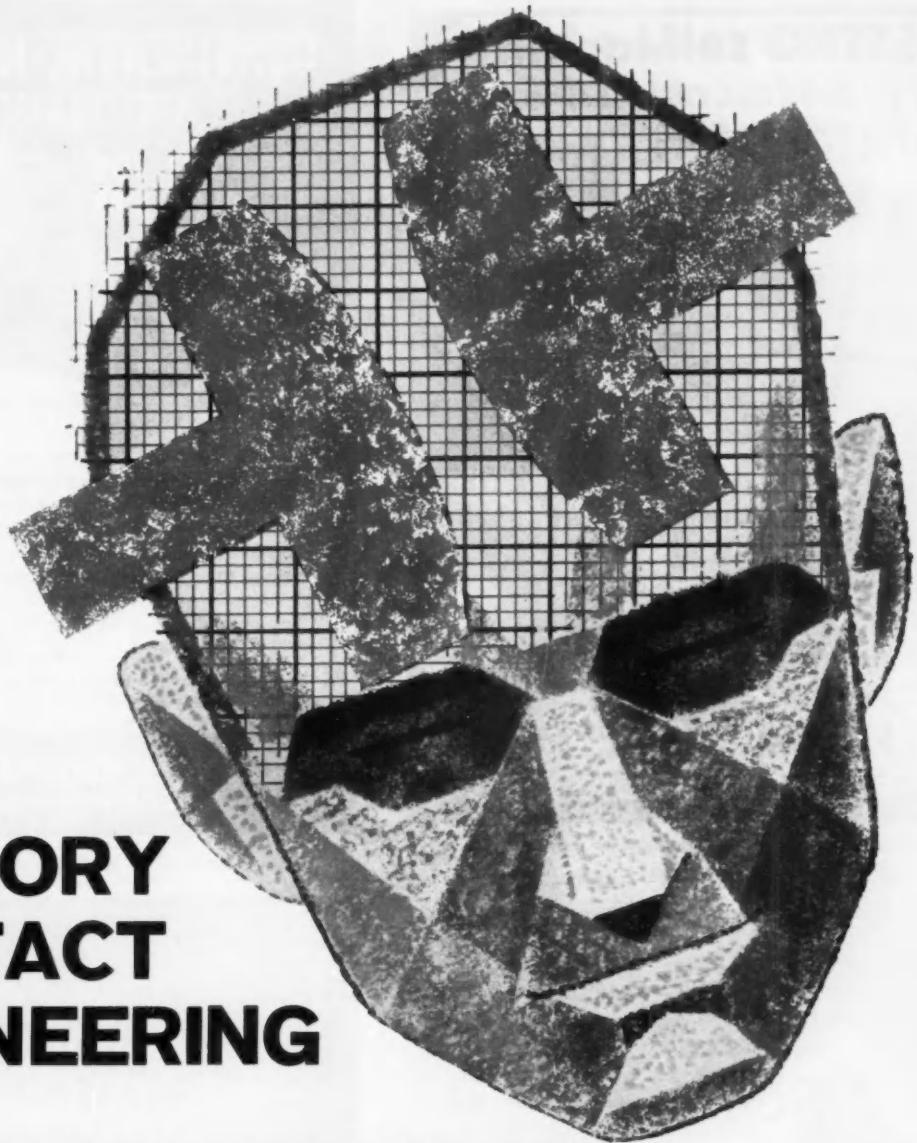
ONLY EATON TRAC-AIDE
OFFERS ALL OF THESE
ADVANTAGES

- No Cams
- One-piece Case
- Few Parts
- Easy Maintenance
- No Lock-up Peaks
- Exclusive Long-Life Disc Design
- No Special Lubricant Required



EATON

PUMP DIVISION
MANUFACTURING COMPANY
9771 FRENCH ROAD • DETROIT 13, MICHIGAN



MALLORY CONTACT ENGINEERING

can cut your contact costs

You may be paying extra for contact design "frills" . . . or for an unnecessarily complex design . . . or even for a basically simple design that causes additional production operations.

Mallory contact engineers are experts in eliminating unessentials in contact designs. Their recommendations may include use of a different contact or backing material, which will meet service requirements and make assembly easier. Or they may modify your design to permit production on high-speed automated assembly machines. They can even develop completely new designs for you, aimed at maximum value at lowest costs.

Our design recommendations are backed by over 40 years' contact experience . . . pioneering in powder metallurgy . . . research in depth. Designs are proved in our laboratory by performance tests in distributors, magnetos, voltage regulators, stop light switches, circuit breakers, relays and other automotive devices. Materials and construction methods are evaluated through arc erosion, endurance and related tests. In

addition, we thoroughly analyze costs of each design—assuring lowest cost for optimum performance.

Mallory specialists have provided customers with this cost-cutting assistance for thousands of contact designs . . . in a variety of types, materials and configurations. We can do the same for you. Bring your design problems to us. Write or call for a consultation.

Mallory Metallurgical Company
Indianapolis 6, Indiana
a division of



SETKO self-locking set screws . . .

WIN FOR YOU EVERY TIME!



FREE "selector chart" shows complete line. Gives over 1,000 possible combinations. Write for your copy and test samples. Send your specifications for recommendations.



Set Screw & Mfg. Co.

16 Main Street, Bartlett, Illinois
© Pat. 2,778,265 *Pat. Applied for

We specialize in solving puzzling screw problems!

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speaking of **ODD SHAPES**
transfer molded



Geauga Industries
can do it for you
... and the low cost
will surprise you.

WRITE TODAY AND SEE!



GEAUGA INDUSTRIES CO.
A Subsidiary of Currie Corporation
MIDDLEFIELD, OHIO

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CONTINENTAL RED SEALS ARE ENGINEERED

AND BUILT FOR THE TOUGH JOBS



It is a significant fact that Red Seal transportation engines find their widest acceptance in the really tough jobs where extra stamina is a prime consideration—in heavy-duty highway trucks and tractors, both as original equipment and as replacements for other makes, in buses, taxicabs, door-to-door delivery vehicles, transport mixers and the like . . . 31 engine models—gasoline, Diesel, LPG, from 26 to 300 horsepower.

AUTHORIZED SERVICE AND GENUINE RED SEAL PARTS AVAILABLE FROM COAST TO COAST

Continental Motors Corporation
MUSKEGON, MICHIGAN

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Quantity
PRODUCTION
of
GREY IRON CASTINGS

ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES

ESTABLISHED 1866
THE WHELAND COMPANY
FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS
CHATTANOOGA 2, TENNESSEE

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WANT "ON-SCHEDULE" HOSE CLAMP DELIVERIES?



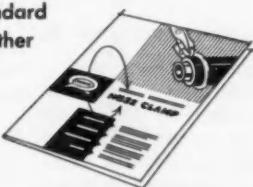
You can count on CORBIN!

Corbin has the capacity to produce hose clamps well in advance of your needs. By a planned program of stock-building, Corbin assures you of consistently on-schedule deliveries — plus reserve stocks for emergencies. For dependable hose clamp supply — by the carton or the carload — count on Corbin . . . makers of the original self-tightening hose clamp, the world's leading hose clamp supplier!

• • • and you get all this from CORBIN, too!

- ✓ PROVEN PERFORMANCE — Used by many leading manufacturers since first introduced
- ✓ VOLUME SUPPLY — Corbin is the world's leading hose clamp supplier — the safe source for volume users
- ✓ SCHEDULED DELIVERIES — Shipments systematically geared to your production schedule
- ✓ RESERVE STOCKS — Emergency needs are promptly met from continuously maintained reserves
- ✓ ALL SIZES — More standard maker sizes than any other

Write for Fact Folder HC20
and Size Specification Sheet

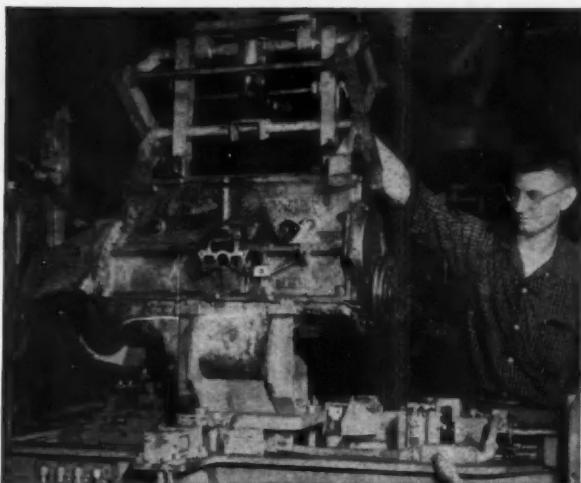


CORBIN HOSE CLAMP DIVISION
THE AMERICAN HARDWARE CORPORATION
NEW BRITAIN, CONNECTICUT

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AUTOMOTIVE INDUSTRIES, June 15, 1960

THIS PRODUCTION LINE IS FASTER, SAFER, WITH HEPPENSTALL TONGS



Being pushed upward into the locked-open Tongs, this engine block will trip a mechanism causing jaws to automatically close.

Air operated lifts are an integral part of the engine block balancers used at Chrysler Corporation's Trenton, Michigan plant. When balancing is completed, the lifts push the blocks upward into Heppenstall Tongs; jaws close automatically, and the block is on its way to the next work station. At the same time, another pair of Heppenstall Tongs is bringing in another block for balancing.

Seventy-five of these 500-lb. capacity Heppenstall Tongs are used to handle 6-cylinder engines of the new Plymouth, Dart and Valiant. Another seventy-five Heppenstall Tongs, slightly different in design, handle V-8 engines on conveyor lines of Dodge, DeSoto, Chrysler and Imperial.

Chances are Heppenstall Tongs can help you more quickly and safely move materials, semi-finished or finished products. For more information, call your Heppenstall Representative. Or, send us your load and operating requirements for a quotation.

HEPPENSTALL COMPANY

Pittsburgh 1, Pennsylvania

PLANTS: Pittsburgh and New Brighton, Pa. • Bridgeport, Conn.

MIDVALE-HEPPENSTALL

COMPANY

Nicetown, Philadelphia 40, Pa.



Die Blocks • forgings • Back-Up Roll Sleeves • Rings • Industrial Knives • Materials Handling Equipment • Pressure Vessels Hardened and Ground Steel Rolls • Vacuum and Consumable Electrode Melted Steels

IF IT HANGS FROM A CRANE . . .
HEPPENSTALL CAN HANDLE IT

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AUTOMOTIVE INDUSTRIES

A CHILTON

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Equipment and New Products described edi-
torially in this issue

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By C. J. Kelly

ASSISTANT EDITOR

Collapsible Taps 1

Bulletin G-94-2 covers a line of collapsible taps that are available in a wide range of sizes. Illustrations and line drawings show the features and charts give the technical specifications. *Landis Machine Co.*

Dust Collector 2

Design and construction details and statistical data are included with illustrations and line drawings in a six page folder that describes a line of dust collectors. *American Standard, Industrial Div.*

Motor Guide 3

A 16 page bulletin outlines the various motor characteristics and includes up to date information on motor designs. Charts cover the ratings and mounting dimensions of the line. *Century Electric Co.*

Clamps and Brackets 4

This manual describes a line of clamps, line supporters, brackets and shims. It includes line drawings and specification data in 96 pages. Featured is a quick reference visual index. *Ta Mfg. Corp.*

Fork Truck Details 5

Dimensional and engineering specifications, and operational advantages of a 2500 lb capacity, battery powered fork truck are presented in a six page brochure. *The Industrial Truck Div., Clark Equipment Co.*

Plastics 6

Materials for fibrous glass reinforced plastics are described in a 16 page booklet. Included are complete ranges of fiber glass fabrics and fibers, polyester and epoxy resins and catalysts, parting agents, pigments and other necessary supplies. Three pages are devoted to property tables and application data. *Cadillac Plastic and Chemical Co.*

Automation Products 7

This literature explains the design and operation of automated equipment, as well as the means of programming and set-up of these units. Controlling associated machines, specifications and parts feeders are also covered in the six page folder. *USI Robodyne Div., US Industries Inc.*

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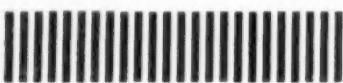
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Fork Lift Catalogs 8

Fork lift features are described and illustrated in two new booklets, that includes specification information, and cut-away drawings of the components, as well. *Allis-Chalmers Mfg. Co.*

Testers 9

A new catalog contains illustrations and a description of 77 testers or equipment units. Many different phases of industry is covered by these units. *Custom Scientific Instruments, Inc.*

Self-Lock Screws 10

An eight page booklet contains illustrations of various types of screws that are equipped with inserts to make them self-locking, vibration-resistant fasteners. Line drawings and charts are included in this publication. *Parker-Kalon*.

Silicone Fluids 11

Charts and graphs are included in a seven page booklet that discusses the properties, evaluation, stability and many other characteristics of these chemicals. *Dow Corning Corp.*

Grinding Wheels 12

Entitled "Grinding Wheels for the Welding Trade" a new booklet describes each kind of grinding wheel used in this trade. Its uses, properties are covered by tables, and along with illustrations, are included to help determine the proper wheel for each specific grinding job. *Norton Co.*

Comparators 13

The complete story on optical comparators is covered in a 40 page brochure that contains illustrations, charts, specification data and technical information. Accessories, lens data and special charts and fixtures are also included. *Jones and Lamson Machine Co.*

High Purity Gases 14

Properties, applications and storage of ultra-high purity gases are the topics of interest in a new 16 page booklet. Some of the gases covered are: argon, neon, helium, krypton, xenon, radioactive gases and special mixtures. Charts, graphs and technical information are included. *Linde Co., Div. of Union Carbide Corp.*

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Automatic Equipment 15

Bulletin 85-60 discusses various types of press room equipment including slide feeds, roll feeds, stock reels and straighteners and coil cradles. Illustrations, specifications charts and construction data are included. *U. S. Tool Co.*

Automation and You 16

A new, management-oriented publication discusses the technology, equipment and economics of automation. The 16 page bulletin assesses the current state of the automation art, summarizes the need and economic benefits of automation, and provides information on six key functions of automation. These functions are: process, control, computing, instrumentation, numerical control of machines, sensing and communications. *General Electric Co., Industrial Electronics Div.*

Coatings 17

A new bulletin discusses high-temperature coatings for maintenance painting and industrial finishing. It provides information on silicone and silicone-ceramic coatings and their use as a protection for metal to heat, wet or dry to 1400 deg F, corrosive atmospheres and weather. *Dampney Co.*

Screw Data 18

A colorful new brochure with dimensional data, illustrations and drawings covers a line of screws. Stanscrew hex, hex, carriage bolts and lag screws are included in six pages. *Standard Screw Co.*

Switch Catalog 19

Technical engineering data and ordering information contained in new full line snap-action switch catalog. Enclosed and open, stack switches are featured for practically unlimited precision snap-action switch applications. *Cherry Electrical Products Corp.*

Power Systems 20

Eleven pages discuss the development of complete and separate power generating systems leading up to the present Vickers line of packaged vehicle power systems. Many illustrations and schematic drawings are included in the booklet. *Vickers Inc.*

Furnace Data 21

A two page folder shows the design features and gives some application information on a line of box type recirculating furnaces. Illustrations, a cut away drawing and charts covers the specifications of these units. *Sunbeam Equipment Corp.*

Abrasive Catalog 22

SAE specifications are shown in chart style for many different types of abrasives. This booklet gives information on costs, applications, types of equipment and other important data. *The Cleveland Metal Abrasive Co.*

Melting Furnaces 23

A complete line of well-established, efficient furnaces for non-ferrous metal melting and holding are described in a twelve page brochure. Numerous illustrations and line drawings show the various products, along with a brief description of each item. *Hevi-Duty Electric Co., a Div. of Basic Products Corp.*

Drafting Tables 24

A new concept in desk high, adjustable, drafting tables is described in a four page folder that includes illustrations and a specification chart. A photograph with arrows to the many features is also shown. *Mayline Co., Inc.*

New Lathe 25

A new heavy duty lathe is described and illustrated in a twelve page bulletin that includes the complete features, specifications and engineering data. *The Nebel Machine Tool Corp.*

Press Catalog 26

Twelve sections in twenty-seven pages cover a line of power presses and their various component parts. Along with many illustrations, specification charts are included to complete the technical facts. *Emhart Mfg. Co.*

Electronic Drives 27

Illustrations, cut-away views, specification charts and line drawings are all included in a brochure that covers a line of industrial electronic select-a-speed drives. *The Louis Allis Co.*

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Footswitches

28

Dimensions, specifications and description references are shown in a data sheet that covers a line of foot switches. Catalog number, type, circuit and rating are given in chart style. *Linemaster Switch Co.*

Gas Storage

32

Oxygen, nitrogen and argon storage and conversion stations are described in a six page brochure that includes illustrations and typical installations. A flow diagram schematic and specifications charts are also shown. *Air Reduction Sales Co.*

Coolant Data

29

Faster speeds, bigger feeds and longer tool life are discussed in a new brochure that shows how machining and grinding operation costs are effected by the coolant that is used. *Master Chemical Corp.*

Designer Aid

33

A new welding aid has been published to assist the engineer, designer and shop personnel. In one easily read table, parent metal combinations of wrought alloys currently recommended for welding, are indicated. *Aluminum Co. of America.*

Steel Comparison

30

A new 24 page tool steel comparison guide has tool steels listed according to AISI-SAE classifications. Included in a handy index reference, listing tool steels by trade name and number. Valuable information for the tool steel buyer is contained on each page. *Peninsular Steel Co.*

Truck Tire Facts

34

Truck tire costs-per-mile data is discussed in a 16 page brochure that shows the results of tests conducted by independent testing organizations. *Tyrex Inc.*

Electric Clutches

35

Diagrammatic sketches of more than 20 types of fixed field, miniature, small and large electric clutches and brakes are included in a 6 page booklet. The size of each type is also listed, together with pertinent data concerning rated static torque and coil power watts. *Simplatrol Products Corp.*

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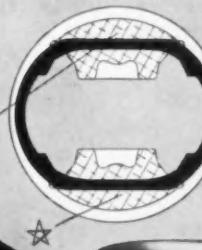
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The "All-Temperature" Piston
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For any gasoline engine, performance superiority of the Zellner "Clear-O-Matic" Piston is outstanding. The expertly engineered design of this great piston development incorporates desired advantages in addition to the basic expansion control feature. Clear-O-Matic is a remarkably cool running piston with 20% greater area of conductivity for heat dissipation. This greater section also provides uncompromised strength for long-life durability. Only Clear-O-Matic has all these vital advantages. We suggest an immediate test for your engine.



STEEL TENSION MEMBER
Anchored only at pin bosses and cast in positive contact with I. D. of piston skirt.

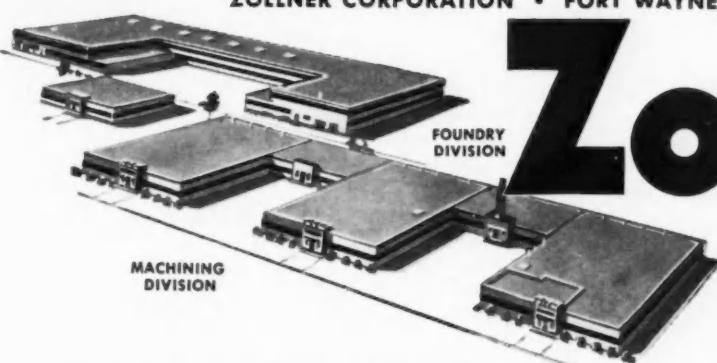
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20% greater section for heat conductivity.

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Design adaptable to
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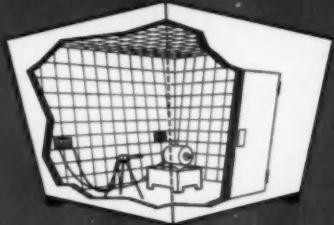
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PRECISION PRODUCTION FROM ENGINEERING TO FOUNDRY TO FINISHED PISTONS

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N/D sound booth for analysis of electric motor noise, mounted on springs and constructed with non-parallel walls, assures manufacturers a scientific solution to electric motor noise problems. Motors are tested with special electronic sound evaluation equipment.

How **N'D** Minimizes Electric Motor Noise!

In New Departure's full-time noise analysis program, a unique sound booth and special electronic sound level equipment are used to pinpoint and evaluate electric motor noise. Inside the booth, a condenser microphone picks up air-borne noise from the running motor. Outside, the signal is electronically registered and recorded.

By changing one variable at a time, such as bearing or mounting design, or lubricant, N/D engineers are able to select the proper com-

bination that results in the quietest motor operation. That's why you'll find New Departure precision ball bearings specified for electric motors to be used in quality home appliances, instruments, fans, hand tools and other applications . . . for greater consumer sales appeal. If you have an electric motor noise problem, contact the N/D Sales Engineer in your area. For additional information call or write New Departure Division, General Motors Corporation, Bristol, Connecticut.



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